

Rock & Gem

JULY 2015

THE EARTH'S TREASURES • MINERALS AND JEWELRY

VOL. 45 ISSUE 07

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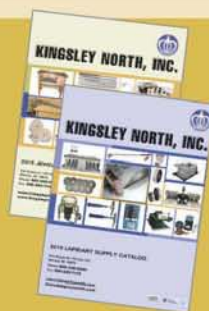
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Rock & Gem

Volume 45, Number 07

July 2015

ON THE COVER

Uranocircite is a uranium mineral that combines beauty with a hint of danger. This specimen is from the Sao Pedro mine in Minas Gerais (Saucui, Malacacheta Dist., Teofilo Ontoni), Brazil. (Beth Van Allen photo, The Arkenstone/iRocks.com specimen)

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Smithsonite - AZ

Photo by Jeff Scovil©

READER LETTERS

Gollar Mine Non Access

In the April *Rock & Gem*, I was pleased to find an article on the Gollar mine in Missouri; finally, someplace relatively close to me (a little under a three-hour drive).

I took the drive, got all the way out there and, wouldn't you know it, there were gates across the road and No Trespassing signs everywhere. I even went down Swift Road a ways and there were still signs. What a disappointment.

Either the author failed to mention this or they were put up after he made his trip.

Just so the trip wasn't totally wasted, I took a 60-mile detour south to Rolla to visit the only rock shop in Missouri: the Fall Creek Rock Shop off Interstate 44, Exit 189.

—J. Ableman
via e-mail

I contacted my former advisor about access to the Gollar mine. Apparently, some time after I left the state, a private paintball and scuba diving company acquired the land. He says there should be a phone number on the entrance and No Trespassing signs. He also said that he still takes class trips there, and the owners are very accommodating with visits by rockhounds—just contact and ask them first.

—Mark Leatherman
Rock & Gem Contributor

As of press time, we had been unable to locate the name and contact information of the current landowner.

—Editor

Project Appreciation

I just wanted to say *thank you* for the terrific project article by Jeff Fulkerson, "The Old Ones" (May 2015). The photos are quite detailed and the general instructions are easy to follow.

My husband is a lapidary artist and I design and create various types of jewelry, which includes metal work, cab setting,

bead work, etc., so this article was "right up our alley." I hope that *Rock & Gem* continues to have additional projects in forthcoming issues.

FYI, the "Old Ones" are also known as the "Anasazi".

—Zoe Schnabel
Cochise, AZ

Rock & Gem will continue to print step-by-step project articles whenever they become available. Interested contributors should refer to our writers' guidelines at www.rockngem.com/writers-guidelines/ for instructions.

—Editor

Agate Lamp Variations

Kevin Kelley, of Peakskill, New York, wrote in the May Field Notes about making lamps of translucent material. Over the years, I have done similar things, but with a few twists.

I got a batch of larger Brazilian agate slabs. Some were fortified and some had lovely tree-scape inclusions. Any agate—Mexican, Superior or Montana—could be used.

I either polished the flat front or used Hughes epoxy on it. I cut some 4X4s into 5-inch chunks and distressed the grain with a wire brush. I rubbed on thinned oil paint for grain or sprayed it with clear matte acrylic and then stained with oil paint, rubbing the excess off.

I slotted them with a $\frac{3}{16}$ -inch router bit or chisels to fit the piece or slab. Even cracked or broken large slabs can be epoxied back together on wax paper. Excess epoxy can be cleaned off with a putty knife and acetone.

They are used as table displays before a lamp that shines through the rear. For Christmas presents, I ordered some small flame lamps and sockets with a light switch cord and a photo cell switch in the socket from a stained glass company. These were made into beautiful nightlights.

Be sure to cement the slab in the slot with some clear silicone so it doesn't become a floor casualty. The lamps were a great treat for everyone.

—Monroe J. Mechling
Steubenville, OH

Send comments to editor@rockngem.com or to Field Notes, *Rock & Gem* magazine, 5235 Mission Oaks Blvd. #201, Camarillo, CA 93012. All submissions are subject to editing for content and length.



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LAPIDARY OF THE MONTH

JULY 2015



I had this rough agate rock that I had bought at a rock show lying around in my shop for a year. Every once in awhile, I would pick it up, analyze it, and lay it right back down. It had too many irregular sides to attempt any decent cuts, so it lay there. Finally, one day, I just cut through it hoping for the best.

Luckily, the first cut showed nice colors and a faint outline that looked promising. I made another cut, and that produced a pattern like a single butterfly wing. I made another cut, and there was a matching wing. The next two cuts had a slightly different pattern, but they also were matching butterfly wings.

I did not have to trim anything else off the wings. I simply polished them using a standard tumbler. However, at this point, I was stumped as to how to make a butterfly body. After making several bodies out of a granite rock, I finally found two that seemed to work. I polished them until they were the right size and contour.

My next problem was how to make the wings and body into a solid butterfly. The project lay unfinished for over a year with me racking my brain to find a solution. Then, one day, I was at a local craft store and found two small, gold butterflies that could

be attached to the underside of the wings and body, which became the foundation of the piece. By bending and adjusting, I finally achieved a good fit; however, I still had no legs or antennae. I tried all kinds of different

wires; some were too soft, and some were too hard.

After another six months of looking, I finally found a gold wire with just enough temper to hold the butterflies upright. After drilling a small hole into the front of the body, I carefully glued the antennae in place with the old reliable E-6000 glue.

Now all that was left was to attach the wings, body, legs, and gold-plated butterflies into a solid piece. The legs had to be positioned in just the right place to hold the butterfly upright. This was the hardest part.

The natural arrangement of the agate colorations lent themselves perfectly to the wings. Had I cut the rock from a different angle, my butterflies would never have emerged from this simple rock. I was fortunate enough to get two complete butterflies from this beautiful agate, leaving only one scrap piece of rock left.

—Tony Goldade
Bismarck, ND



Would you like to be named Lapidary of the Month?

To enter the contest:

- Write a 500-word step-by-step description of how you crafted your lapidary project from start to finish. Save it as a document file.
- Take at least one sharp, close-up, color digital photo of the finished project. Photos must be high-resolution (300 dpi at 4 inches by 5 inches, minimum).
- Attach your document file and digital photo (.tif or .jpg) to an e-mail and send it to editor@rockngem.com with the subject line "Lapidary of the Month".
- Make sure you include your name and street address (not a PO Box)



for prize delivery should your entry be selected for publication. Only winners will be notified. E-mail the editor or call (972) 448-4626 with any questions about these requirements.

Lapidary of the Month winners receive a two-speed Dremel Model 200 N/40 MultiPro kit and a wall plaque in recognition of their creativity and craftsmanship. Winning projects are also posted on our Web site, www.rockngem.com.

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2-5—SISTERS, OREGON: Annual show; Jean Miller, Sisters Elementary School; 611 E. Cascade (off Hwy 20); Daily 9 am-6 pm; Admission is Free; Beads, Gems, Minerals, Fossils, Crystals, Jewelry, Grab Bags, Turquoise, Petrified Wood, Thunder Eggs, Rough and Polished Rock and much, much more. Fun for the whole family; contact Jean Miller, (971) 219-0323; e-mail: karmicbead-sandgems@yahoo.com

3-5—FARMINGTON, NEW MEXICO: Annual show; San Juan County Gem & Mineral Society, Farmington Civic Center; 200 W. Arrington 87401; Fri. 10:00 am-6:00 pm, Sat. 10:00 am-6:00 pm, Sun. 10:00 am-5:00 pm; No Admission fee; hourly door prizes Wheel of Fortune-children Raffle for Amethyst Cathedral, 6" Trim Saw, Rock Tumbler, Tow rock Picks Silent Auction Black Light Display; contact Mickie Calvert, 5986 Hwy 64, Farmington, NM 87401, (505) 632 8288; e-mail: mickie2@earthlink.net; Web site: none

3-5—EUGENE, OREGON: Wholesale and retail show; Gem Faire Inc, Lane County Events Center; 796 W 13th Ave; Fri. Noon-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Adults, Seniors + Students \$7, Children ages 0 - 11 are free; Fine jewelry, precious & semi-precious gemstones, millions of beads, crystals, gold & silver, minerals & much more at manufacturer's prices. Exhibitors from around the world. Jewelry repair & cleaning while you shop. Free hourly door prizes. ; contact Yooy Nelson, (503) 252-8300; e-mail: info@gem-faire.com; Web site: <http://www.gemfaire.com>

5-5—PICKTON, ONTARIO, CANADA: Annual show; Kingston Lapidary and Mineral Club, Crystal Palace; 375 Main Street, Canada; Sun. 10:00 am-5:00 pm; Admission is \$3.00, Children 12 and under free; Gem Shower - hosted by the Kingston Lapidary and Mineral Club. Rekindle the rockhound in you and discover nature's treasures at the fourth annual show and sale Sunday July 5 - showcasing gem and mineral, lapidary and jewellery vendors from across Ontario & Quebec in the historic Crystal Palace - PEC Fairgrounds, 375 Main Street, Picton ON; contact John Zandarin, 537 County Road 35, RR2, Picton, ON, Canada K0K 2T0, (613) 476-5510; e-mail: howhardcanitbe@sympatico.ca

10-12—PORTLAND, OREGON:

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11-12—TULSA, OKLAHOMA: Annual show; Tulsa Rock and Mineral Society, Central Park Hall-Tulsa County Fairgrounds; 4145 E. 21st St.; Sat. 9:00 am-6:00 pm, Sun. 10:00 am-5:00 pm; Adults + Seniors + Students \$6.00, 12 and under free with paid adult; Tulsa Rock and Mineral Society's Annual Gem & Mineral Show will be Saturday, July 11 and Sunday, July 12 at Central Park Hall at the Tulsa County Fairgrounds located on 21st Street between Harvard and Yale. Hours are 9 a.m.-6 pm. Saturday and 10 a.m.-5 p.m. on Sunday. Includes Gems, Beads, Fossils, Jewelry, Crystals, Working Exhibits, Free Kid's Zone and Demonstrations. Admission is \$6 for Adults, Kids 12 and under Free with paid adult, Scout and Military Free-in uniform. ; contact Martha Rongey, 612 W. 120th St. S., Jenks, OK 74037, (918) 230-1094; e-mail: m_rongey@sbcglobal.net; Web site: www.ttownrockhound.org

11-12—CASPER, WYOMING: Annual show; Natrona County Rockhounds Club, Parkway Plaza Hotel; 123 West E Street; Sat. 9 am-5 pm, Sun. 9 am-4 pm; Adults \$3.00, Children Under 12 Free; Demonstrations, door prizes, raffle, and silent auction; contact Tom Catania, 634 South Melrose, Casper, WY 82601, (307) 258-4884; e-mail: catania82601@aol.com

11-12—BETHEL, MAINE: Annual show; Oxford County Mineral & Gem Association, Telstar High School; RTE#26; Sat. 10 am-5 pm, Sun. 10 am-4 pm; Adults \$3.00, Children under 12 are FREE!; This is our 54th annual show. We offer Mineral display's of locale Mineral's. We have 14 dealer's selling Jewelry and Mineral Specimens from assorted locations. We also offer guided Field Trips to a locale mine each day. You must be at the show to sign up for the field trip. Field trip's leave each day by 11am. ; contact Dennis

continued on page 16

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My Favorite Minerals

PART I:

Bournonite, Rhodochrosite and Epidote

Story and Photos by Bob Jones

Every mineral collector and mineral dealer has a small group of minerals they favor above all others. Perhaps it's a mineral that exhibits exceptional color. Maybe it's the crystal forms a species exhibits. Some collectors specialize in a locality, or a particular species, such as quartz. Some collect nothing but gem crystals, sometimes matching the natural crystal with a cut gem of the same material. There are probably as many variations on collecting as there are collectors.

When I started collecting back before World War II, I just collected anything, giving little thought to it. After the war, I made a trip to Franklin, New Jersey, a site that would later be named the Fluorescent Mineral Capital of the World. After that, I focused on collecting minerals that fluoresced.

ROB LAVINSKY PHOTO



This elegant spray of deep-green epidote comes from Pampa Blanca (Ica Department), Peru.

BEATRICE MURCHIVA WIKIMEDIA COMMONS



A great variety of banded rhodochrosite was mined at the Capillitas mine (Catamarca Province), in the Argentine mountains.

Once I moved to Arizona in the 1950s, my collecting tastes expanded to include worldwide species. When that proved too costly, I sold off my fluorescent mineral collection and specialized in copper and lead minerals.

After years of collecting, traveling, and writing about minerals, I have narrowed my interests to about a dozen species. In some cases, it was because I have been able to collect very nice examples of a mineral like wulfenite and agate. In the case of selenite, my interest grew out of exceptional experiences of visiting caves in Mexico: the Caverna de Santo Domingo and what I call "Caverna de Crystalas Giganto", home of the huge, 40- to 50-foot selenite crystals at Naica, Mexico.

Living in Arizona and having collected the dumps at Bisbee, it is only natural that I enjoy azurite, malachite and cuprite, whose crystals, color and availability make them natural subjects to collect. The colored varieties of smithsonite also make it an attractive species to collect. Another carbonate I enjoy is cerussite because of the many crystal varieties it has and the many opportunities I've had to collect this lead carbonate.

My fascination with epidote goes back to the first formal collection I ever saw, at Yale University in New Haven, Connecticut. Among the amazing specimens in that collection was a small mass of byssolite with epidote crystals jutting from it like spines from a hedgehog. For some reason, that specimen has stuck with me for decades, resulting in epidote being a favorite of mine.

Finally, my travels to England, my writings, and particularly my interest in classic localities and species have long caused me to really enjoy bournonite and chalcocite. The latter mineral was a major ore at Bristol, Connecticut, in the 1800s, when the Connecticut brass and clock industries developed.

Bournonite caught my attention because of the amazing cogwheel twin specimens that were found in a couple of mines in Cornwall, England, and more recently in China. All together, these 12 species are my favorite minerals to collect, write about, and read about. Visiting mines that produce them is my ultimate goal, even when I can only look and not collect.

BOURNONITE

Most collectors are attracted to minerals with bright colors. I am, too, but there are many other reasons to like minerals: crystal form, history, personal taste, and so on.

One such is bournonite, a gray-black mineral with a very unusual twinning form. When Cornish miners ran into crystallized bournonite, they were amazed that the crystals looked like the gears on their mining machinery, so they called them "cogwheels". Not all bournonite forms as twins, but those that do are fascinating.



PHOTO COURTESY THE ARKENSTONE

This cogwheel bournonite from the Yougangxian mine, China, is an exciting example of this uncommon mineral.

Bournonite was initially found at Wheal Boys, in Cornwall, England, and was named for Count Bournon, a French mineralogist. When I was in the Natural History Museum in Paris, I saw Bournon's original specimens on display, but none were cogwheels.

To see some of the finest original cogwheel bournonites, you have to visit the Natural History Museum, London. The crystals on display there are from three Cornish localities, the type locality Wheal Boys and the Herodsfoot mine, near Liskeard and later at Wheal Newton. Some of the crystals from these mines are 3 inches across and are associated with quartz crystals.

The odd, gearlike form of the mineral is due to the twinning of four crystals. Each has a blunted, wedge-shaped termination made of a small, flat surface and two sloping faces. When twinned side by side, the terminations form square notches, just like gear teeth. Unfortunately, the Cornish

mines are long since closed and will never open again.

Bournonite has been found in a host of places in Europe Japan, Bolivia, Utah and Mexico. Some of the crystals from these localities are typically tabular, each reaching an inch or two in length. In Bolivia, crystals from the Vibora mine were sometimes 4 inches long, but cogwheel crystals were only found in Cornwall until recently.

In the last decade, a new source has emerged that produces specimens that rival the classics from Cornwall. The Yao-gangxian mine, at Changzhou (Hunan Province), China, has produced wonderful cogwheel crystals that are sometimes over 2 inches across. Slender blades consisting of a pair of crystals, twinned vertically and measuring 4 inches or longer, are also coming from this wonderful mineral source. The longest of these are an incredible 10 inches! Anyone who collects this

copper, lead, antimony sulfide can enjoy new collecting life thanks to Chinese bournonite.

RHODOCHROSITE

Bright-red rhodochrosite contrasts nicely with the gray-black color of bournonite when they sit on a display shelf. Rhodochrosite, a manganese carbonate, is found in a variety of colors, from tan to brown, wine, pink and red. It is the pink-to-red shades of this common carbonate that are most popular. Another property that makes rhodochrosite popular is its simple crystal forms. There's nothing complex about a dogtooth crystal or a simple, sharp-edged rhombohedron, the two common crystal forms for the mineral. It is also found in platy, disklike crystals, often with an odd brownish color, but these are uncommon.

There are two sources for spectacular rhodochrosite: the Black Rock district in the Kalahari Desert (South Africa) and the Sweet Home mine at Alma, Colorado. Specimens from these sources are among the more highly prized. The many other sources rank below these two in the hearts and minds of collectors.

In Europe, rhodochrosite has been found in Romania, at Kapnik and elsewhere. The crystals here are rhombic and can have a good pink color. In Germany, the mineral was found in tiny, fat, pale pink scalenohedrons.

The metal mines of Pasto Buena, Peru, are very well known for superb, rhombic, red rhodochrosite with quartz. These are exceptional in quality and are highly valued by collectors. Other Peruvian mines, like the Uchucchacua, have yielded equally fine, red rhodochrosite, but these have formed in dogtooth or scalenohedral crystals that are nearly 2 inches long.

The finest dogtooth crystals are from the Hotazel mine, the N'Chwaning II mine, and the Kalahari manganese fields of North Province, South Africa. One of the discoverers of these huge deposits was a man named Sacco. His son, Desmond Sacco, has a remarkable collection of minerals from around the world that is highlighted by superb rhodochrosite from these mines.

Bruce Caincross wrote a book on these mines that especially highlighted rhodochrosite, and another book on the Sacco collection. You can find them on the Internet, and they are worth adding to your library. Check out *The Manganese Adventure* (1997), for starters.

These mines have produced the finest, richest gem-red dogtooth crystals known. For a period of time in the 1970s and '80s, exceptional plates of these crystals were being mined. Some of the crystals, usually gem quality, approached 4 inches in length and were an intense red. They sit on a black manganese matrix, usually manganite.

The world's finest rhombohedral rhodochrosite is from the Sweet Home mine. Located on the eastern slopes of the Mosquito Range, the Sweet Home was worked for silver, but not very successfully. In the 1950s, the discovery of a few crystals brought rockhounds to the Sweet Home mine site. I visited it in 1957 and again a few years later, but without any success.

In the early 1990s, a group of 10 investors was organized by Bryan Lees of The Collector's Edge, in Golden, Colorado. After putting much effort into cleaning up the mine and making it safe, they began mining for crystals. Careful studies of the rock formations revealed clues to the mineral-bearing seams, and mining enjoyed some success.

Small, rich pockets of crystals were mined. When the pockets seemed to play out, the miners brought in ground-penetrating radar. Continued mining proved very successful. Working one seam exposed a wall measuring some 8 feet high and wide. It was decorated with hundreds of lovely, red, 1-inch rhombs. The entire wall was excavated and re-assembled for

ROB LAVINSKY PHOTO



The terminations of the monodinic epidote crystals from Untersalzbachthal, Austria, are sometimes severely slanted.

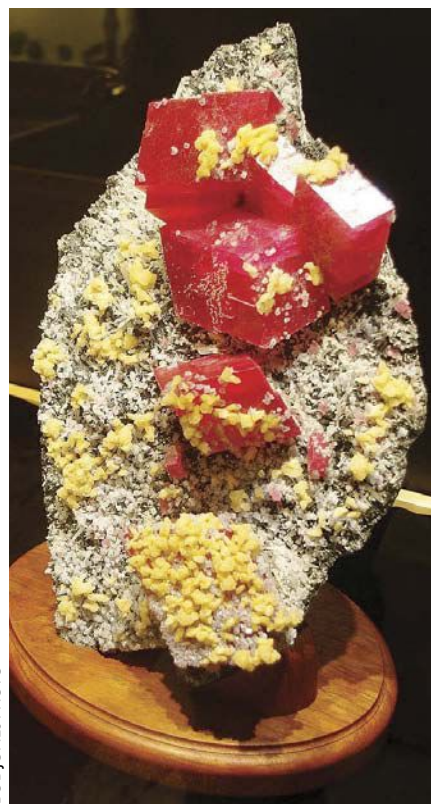
ROB LAVINSKY PHOTO



In the Capillitas mine, huge red-to-pink stalactites formed that, when cut in cross section, yielded slices of radiating crystalline and banded rhodochrosite.



The classic cogwheel bournonite crystals from England are eagerly sought by collectors.



The Alma Rose rhodochrosite, from the Sweet Home mine, is displayed in the Rice Northwest Museum.

installation as an exhibit in the Denver Museum of Nature and Science (DMNS).

Coincidentally, a television crew was filming the specimen mining when a seam being worked opened up and a loose, 5-inch single crystal was exposed. Lees was filmed carefully removing the crystal. Then, using a diamond saw, he cut out the wall rock where the crystal had grown. The reassembled specimen was sold to the DMNS. Called the Alma King, it is the largest known single rhodochrosite crystal.

The mine also produced the Alma Queen, which I consider the finest specimen of rhodochrosite, bar none. The Alma Queen resides in the Rice Northwest Rock and Mineral Museum in Hillsboro, Oregon (near Portland). This private museum should be at the top of every rockhound's agenda. The Alma Queen stands about 15 inches high and has four amazing 3- and 4-inch red rhombs on it. They sit on a flat plate covered with small, bright quartz crystals, with minor fluorite and sulfide minerals. This is a most remarkable specimen.

What collector has not seen the great variety of banded rhodochrosite mined at the Capillitas mine (Catamarca Province), in the Argentine mountains? Discovered by locals long before European explorers showed up, the deposit was worked for silver and for ornamental, red rhodochrosite. The mineral formed huge red-to-pink stalactites that, when cut in cross section, yielded slices of red radiating rhodochrosite, both crystalline and banded. In some cases, a large slice has a dozen eyes, with the surrounding bands being delightfully intergrown. Looking like bright-red agate, the mineral is also made into beads, ashtrays, carved animals and whatever else the lapidary can dream up. In spite of being massive this lovely rhodochrosite should be in every collector's inventory!

EPIDOTE

Another of my favorite minerals, epidote, ranges in color from dark green to light green. Some epidotes are such a dark green they appear black, except on thin edges. Others are called "pistachio green" because their color is so eye appealing. This calcium aluminum iron sorosilicate is a very common mineral, but superb crystals are not abundant. If you have ever picked up a rock that has

a greenish smear on it, you may be looking at epidote. However, there are magnificent dark-green, monoclinic blades from Unterzibachtal, Austria. These crystals are often twinned, striated and lustrous, and some of them are well over a foot long. They really are attractive: a rich, dark green in the body of the crystal with lighter green edges. Their monoclinic crystal form gives them interesting terminations that are sometimes severely slanted.

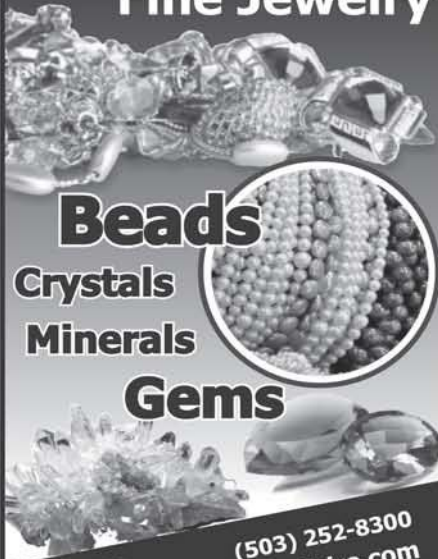
As mentioned, epidote is a remarkably common mineral. It forms in relatively low-temperature deposits, and its chemical formula seems to resemble a garbage can. In one molecule of epidote, there are about two dozen atoms, including aluminum, iron, calcium, silicon, oxygen, and a couple of OH radicals. Fine crystals have been found in the Czech Republic, Mexico, Romania, Bulgaria, New England, Colorado, California, Peru, Italy, France, Namibia, and many other places.

Aside from the Austrian locality, two others are high on the collector's list: Pakistan and Alaska. The Alaska epidote is very different from the Austrian variety. The crystals are tabular, blocky, and very often twinned, so they have a relatively blunt termination. When twinned, the terminations have distinct chevron patterns on them. The faces are frequently striated, and the epidote often has glass-clear quartz associated with it or attached to it; ideally, the quartz is Japan Law-twinned. This is a delightful pairing of two minerals that contrast nicely.

The epidote crystals from Pakistan can easily pass for Austrian beauties: they are long, developed mainly in subparallel groupings, are seldom twinned, but have deeply inclined terminations. Their luster is as good as Austria's best. They show the light-green color of epidote along the edges and a deep, lustrous green in the main body. They have been mined in the Turniq Valley, Achuri, and at Dassau in the Skardu district, Northern Area, Pakistan. These areas are in the Zagros Mountains, which have been very productive of fine minerals. ♦

This article just touched on these three minerals; any good mineral book will treat them in greater depth. Part II will highlight azurite, malachite, cuprite and agate.

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16-18—CODY, WYOMING: RMFMS Mineral & Gem Show; WY State Mineral and Gem Society, Cody H.S. Sweitzer Gymnasium; 920 Beck Avenue, Cody, WY 82414; Thu. 4:00 p.m.-8:00 p.m., Fri. 10:00 am-8:00 pm, Sat. 10:00 am-4:00 pm; Adults \$4.00, Students \$2, Children are Free!; Annual Rocky Mountain Federation of Mineralogical Societies Mineral and Gem Show will feature: Multi-State Dealers, Demonstrations/Displays, Educational Activities, Kids Activity Area, Speakers, and Field Trips.; contact Stan Strike, 2132 Gail Lane, Cody, WY 82414, (307) 250-1244; e-mail: wsmgspr@wymineralandgemsociety.org; Web site: www.wymineralandgemsociety.org

17-19—SAN RAFAEL, CALIFORNIA: Wholesale and retail show; Gem Faire Inc, Marin Center; 10 Avenue of the Flags; Fri. Noon-6pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Admission is Free!; Fine jewelry, precious & semi-precious gemstones, millions of beads, crystals, gold & silver, minerals & much more at manufacturer's prices. Exhibitors from around the world. Jewelry repair & cleaning while you shop. Free hourly door prizes. ; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: http://www.gemfaire.com

17-19—REEDSPORT, OREGON: Annual show; Lower Umpqua Gem & Lapidary Society, Reedspport Community Bld.; 415 Winchester Ave.; Fri. 10:00 am-5:00 pm, Sat. 10:00 am-5:00 pm, Sun. 10:00 am-4:00 pm; Admission Price is a Donation; Raffle drawing, silent auction, kids scavenger hunt, vendors and display cases; contact Susan Baughman, 105 Ocean View Ct., Florence, OR 97439

17-19—VIRGINIA BEACH, VIRGINIA: Retail show; Treasures of the Earth, Inc., Virginia Beach Convention Center; 1000 19th St.; Fri. 12 noon-6 pm, Sat. 10 am-5 pm, Sun. 10 am-4 pm; Adults \$5.00, Military Free with ID, Children 16 and under Free; Vendors from across the US bring their merchandise to you. You will find • 14K and sterling silver, classic, estate, fashion and handmade jewelry • Loose stones, beads and findings, pearls • Mineral specimens, crystals, lapidary supplies • Books, carvings and gift items Displays and demonstrations by the two Gem & Mineral Societies in the area Appraisals available on site; contact Jane Westbrook, PO Box 59, Gloucester Point, VA 23062, (804) 285-4281; e-mail: jane@treasuresoftheearth.com; Web site: www.treasuresoftheearth.com

18-19—DARRINGTON, WASHINGTON: Rock and Gem Show and Sale; Darrington Rock and Gem Club, Mansford Grange; 1265 Railroad Avenue,

(behind IGA); Sat. 10 am-5 pm, Sun. 10 am-5 pm; Admission is Free!; Field Trip – Saturday 11:00 to collect Travertine Kids Activities; Jade Displays; Raffle; Door Prizes; Rock Collecting Maps; Used Tools; Custom Rock Cutting; Dealer Certificates; Free Rocks; Highly Skilled Amateur Dealers (No Commercial Dealers) ; contact Ed Lehman, (425) 334-6282; e-mail: wsmced@hotmail.com

18-19—ERIE, PENNSYLVANIA: Show and sale; Gem City Rock & Mineral Society, JMC Ice Arena; 423 W 38th Street; Sat. 10:00 am-6:00 pm, Sun. 10:00 am-5:00 pm; Adults \$4, Seniors \$3, Children under 12 Free; 46th annual show and sale; rocks, gems, jewelry, minerals, fossils, wire wrapping, beads, Discovery Blocks, door prizes, activities for children; contact Bob Gallivan, (814) 454-6770; e-mail: gallivan@lycos.com; Web site: www.gemcityrockclub.org/show

18-19—DARRINGTON, WASHINGTON: Annual show; Darrington Rock Club, Mansford Grange; 1265 Railroad Ave; Sat. 10:00 am-5:00 pm, Sun. 10:00 am-5:00 pm; Admission is Free!; Kids activities, door prizes, Saturday 11:00 fieldtrip, jade displays, Display cases, Gem maps, used tools, custom cutting, free rocks, and rock identification.; contact Ed Lehman, 9120 20th St SE, Lake Stevens, WA 98258-4712, (425) 334-6282; e-mail: wsmced@hotmail.com

18-19—MOOSE LAKE, MINNESOTA: Annual show; Carlton County Gem and Mineral Club, Moose Lake High School; 413 Birch Avenue; Sat. 9:00 am-5:00 pm, Sun. 9:00 am-4:00 pm; Admission is Free!; 46th Annual Show, "Agate Days," Carlton County Gem & Mineral Club and Moose Lake Area Chamber of Commerce; Moose Lake High School gym and rear parking lot, 413 Birch Ave; Sat 9-5, Sun 9-4; Free Admission; dealers, Lake Superior agate, cutting materials, specimens, crystal groups, fossils, gems, jewelry, lapidary equipment, rough rock tailgaters, door prizes, field information. Agate Stampede Sat 2 pm Elm St., Contacts: Re Inside vendors: Gary Pitoscia, 815 N 13th Ave East, Duluth, MN 55805 218 724-1894, pitosciajg@charter.net; Tailgators: Carol Risdon 113 Ave C #1, Cloquet, MN 55720, 218 879-3968, carolannrisdon@gmail.com. Free Admission to Geological Center, Moose Lake State Park.; contact Ted Chura, 570 Marshall Street, Duluth, MN 55803-1981, (218) 728-1082; e-mail: tedcgo@yahoo.com

22-26—FRANKLIN, NORTH CAROLINA: Annual show; Damian BellGali, Echo Valley Show Plave (across From GLW); 6456 Sylva Rd. (across fr GLW); Wed. 9 am-5 pm, Thu. 9 am-5 pm, Fri. 9 am-5 pm, Sat. 9 am-5 pm; Admission is Free; Wholesale and retail dealers from around the world selling minerals, fossils, gem, and rough rock; open to the public Sunday hours 9-4pm; contact Damian Bellgali, (678) 852-8273; e-mail: mandybelghali@yahoo.com

24-26—EUREKA, CALIFORNIA:

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25-26—SOUTH BURLINGTON, VERMONT:

Annual show; Burlington Gem and Mineral Club, Frederick H. Tuttle Middle School; 500 Dorset Street; Sat. 10:00 am-5:00 pm, Sun. 10:00 am-5:00 pm; Adults (16-59) \$4, Seniors (60+) \$3, Children Under 16 free with adult; Vermont's largest gem, mineral, and fossil show returns for its 36th year! Thousands of beautiful natural specimens and jewelry are available at affordable prices from 14 dealers. Stunning exhibits, informative lectures, raffle, silent auction, door prizes, and activities for kids. Free parking and refreshments available.; contact Jeff Higgins, (802) 849-6076; e-mail: jhiggins@surfglobal.net; Web site: <http://www.burlingtongemandmineralclub.org/show.html>

25-26—CUTCHOGUE, NEW YORK:

Annual show; Long Island Mineral & Geology Society, Cutchogue East Elementary School; 34900 Main Road (Rte. 25); Sat. 10:00 am-5:00 pm, Sun. 10:00 am-5:00 pm; Adults \$6.00, Children are Free; Jewelry, Minerals, Gems, Fossils, Beads, Geodes, scavenger hunt for children; contact Eugene Genova; e-mail: ligeo@aol.com; Web site: www.liminelandgeology.com

26-26—BANCROFT, ONTARIO, CANADA:

Annual show; Bancroft Gem & Mineral Club, Bancroft Legion Hall; Station Street, Canada; Sun. 10 am-4 pm; Adults \$3.00, Seniors \$3.00, Children are Free!; Featuring Apatite & Phosphate Minerals; contact Frank Melanson, 27001 Hwy 62 LAmable Ont.Canada, ON, Canada K0L 2L0, (613) 332-1032; e-mail: wfmelanson@sympatico.ca

July 2015-August 2015

31-2—NORTH BEND, OREGON: 53rd Annual Gem and Mineral Show - Are You Ready to Rock?; Far West Lapidary and Gem Society, North Bend Community Center; 2222 Broadway; Fri. 10 am-5 pm, Sat. 10 am-5 pm, Sun. 10 am-4 pm; Adults \$1, Children under 12 free; contact Don Innes, (541) 396-5722; e-mail: doninnes.innes20@gmail.com

31-2—SANTA BARBARA, CALIFORNIA:

Wholesale and retail show; Gem Faire Inc, Earl Warren Showgrounds; 3400 Calle Real; Fri. Noon-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Students, Adults

continued on page 33



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BENCH TIPS

by BOB RUSH

Get a Grip on It

There are many methods that can be used to grip a rock in a rock saw for slabbing. Usually, using wedges and braces around the rock will allow the first cut and additional cuts to be made. Unfortunately, rocks aren't symmetrical, so it is difficult to secure them in the saw so that first cut is the optimal cut.

Almost always, the first cut has to be done in whatever way the rock can be safely secured in the rock clamp. I decided that what I really needed was a method to grip the rock in any possible orientation, especially a direction that makes the first and subsequent cuts the best they can be.

After studying the various rock grippers on the market, I compared their good points and their shortcomings and decided there might be a better way to grip a rock. I wanted a very durable, positive method that was quick to achieve and install in the saw. I experimented with a few devices and came up with a simple, quick and secure means of gripping a rock.

The device I came up with consists of two identical jaws made from 6-inch-long strips of 2-inch-wide, 1/4-inch-thick cold rolled steel, which is available from most steel suppliers. There is a V-slot cut into the face of each one, close to the end, that creates sharp tips that will grip the rock.

I made the V-slots on a milling machine, though they could be cut into the steel with a hand grinder, using a small, metal cut-off wheel. The critical aspects of the slots are that the sharp tips are straight and the slots go about halfway through the metal strips.

Two 5/8-inch-diameter holes are drilled in the jaws 1 inch from the back end and 2 1/2 inches apart. These holes are intentionally made larger in diameter than the bolts that go through them so that the jaws have some room to move about as the rock is being gripped.

The other parts that go into this device are two 6-inch-long, fully threaded 1/2-13 bolts and four 1/2-13 jam nuts. Two of the jam nuts are threaded onto the bolts above the lower jaw and tightened against the top of the plate. A third nut is threaded onto the back bolt and the top jaw plate is lowered over the bolts so that it rests on this nut. The final nut is threaded onto the front bolt and tightened against the top of the jaw plate.



The rock, held by the gripper, is mounted in the saw. The entire process takes about two minutes.



Mount the rock in the gripper by placing the sharp tips of the jaws in the notches.



The rock, held by the gripper, is mounted in the saw. The entire process takes about two minutes.

The rock I had chosen to cut had a fractured face that showed white banding and green moss. I wanted to grip the rock so that all the cuts I made were parallel to this face. The back of the rock was rounded, so it couldn't be gripped by any other means.

I notched the rock with two parallel slots, positioned opposite each other and spaced about 3 to 4 inches apart, using an arbor-mounted, 4 1/2-inch dry diamond blade.

I mounted the rock in the gripper by placing the jaw points in the notches and tightening the nuts. Note that the nut on the bolt closest to the rock is on top of the moveable jaw and the nut on the back bolt is below the moveable jaw.

As I mounted the rock, I tightened the top nut nearest the rock first, then tightened the back nut upward against the jaw. This nut adds significant pressure to the rock due to the leverage of the top jaw. I gripped the rock and tried to move it to test the hold. The rock didn't move at all.

Finally, I mounted the gripped rock in the saw. The total time it took me to select the rock, determine the optimal way to slab it, notch the rock, mount it in the gripper, and mount the gripped rock in the saw was about two minutes. 💎



Using the gripper allows the lapidary to slab the entire rock, leaving no waste.

Bob Rush has worked in lapidary since 1958 and metal work and jewelry since 1972. He teaches at clubs and at Camp Paradise. Contact him at rocksbob@sbcglobal.net.



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PETRIFIED WOOD IDENTIFICATION



Angiosperm woods can be divided into three major anatomical groups when cells are viewed in cross section. This one is called ring porous. Note the large vessels.



In tangential sections, structures called rays are easily seen. This slide of a sycamore shows the large rays that are made up of numerous small cells.

Get to Know Your Specimens

Story by Jim Landon

Petrified wood has been a mainstay of the lapidary and rockhounding worlds since their inception. This abundant material is available worldwide and is often the type of specimen budding rockhounds start their collections with. It is easily recognizable and comes in an almost endless variety of colors and patterns.

People tend to want to know what kind of wood they have found or purchased. Fossil wood identification can be quite tricky, especially if an attempt is being made to try and assign the name and taxonomic affinity of a living species to a fossil specimen. The taxonomic assignment of tree species into distinctive families, genera and species is based on a number of distinguishing features that include leaf structure, flower and wood anatomy, pollen, seed and fruit anatomy, and more recently, genetic makeup. These features not only show relatedness between species, but also allow different species to be distinguished from each other.



Faint growth rings are visible in this cross section of Pliocene-age fossil oak mostly because of large spring wood vessels.



Once sections in the three different orientations are prepared, they are glued to glass slides so that they can be cut and ground.



Final preparation of the slide is accomplished by further thinning the section on a flat lap. Many attempts may be needed to get the thickness just right.

Unfortunately, when dealing with fossil wood most of these features are either not preserved or cannot be directly associated with specific tree species, except in those uncommon sites where multiple forms of preservation are present. The one feature that is commonly used to identify fossil wood is the anatomy of the wood itself. In many cases, different tree species have distinctive cell patterns that allow them to be distinguished from each other. This is especially true when working with angiosperms (plants and trees that have flowers).

The wood anatomy of angiosperms tends to be more diverse and distinctive than that of gymnosperms (trees that produce cones). In temperate climates, angiosperms generally are deciduous (lose their leaves in the winter), while gymnosperms are evergreen, although there are exceptions in both groups.

Most petrified wood can easily be distinguished from ordinary rocks by the grain pattern seen on the surface. Determining whether it is an angiosperm or gymnosperm and what kind can quickly become problematic. Identification depends on the quality of cell preservation in the specimen you are working with.

In some localities, no wood anatomy has been preserved and trees are represented only as replacement casts, where all of the wood rotted or burned away, leaving only a hollow mold that was later filled with silica. The replacement limb casts found in Wiggins Fork Creek, Wyoming, and those that produced Montana agate in the Yellowstone River drainage, Montana, are familiar examples.

In other localities, cellular anatomy is preserved just well enough for annual growth rings to be distinguished. From this, whether the tree was an angiosperm or a gymnosperm can be determined. Fortunately, there are many localities in which the cell preservation is so perfect that even the minute anatomy of individual cells can be studied.

This was true for a site I studied while working on my master's degree at the University of Nebraska, Lincoln. I worked on a fossil wood flora from the Oligocene White River Badlands in northwest Nebraska. The fossil wood from this area is a deep, dark brown to almost black. Outwardly it doesn't look like much, but when thin sectioned, the cell preservation is found to be exceptional.

Another locality of note is the ginkgo petrified forest that was discovered in the Columbia River flood basalts near Vantage, Washington. The state park and associated museum have a great display of identified cut and polished petrified wood rounds, including the ginkgo for which the site is known.

This leads to the next part of this discussion: When a piece of fossil wood is discovered, how does one go about actually figuring out what it might be? Individuals who study and identify petrified wood professionally prepare specimens in a specific way so that the cell anatomy can be viewed. First, cross, radial and tangential sections are prepared so that the cell structure in these different orientations can be determined.

These are done by using a diamond rock saw to cut a specimen in a direction that is perpendicular to the long axis of the tree it came from. Think of it like using a chain saw to cut a section from a log. The cut face would be the cross section. A cube of this piece is then ground smooth on a flat lap and glued to a glass slide using epoxy resin. A specialized jig is then used to shave off a thin slice of the cube that remains firmly

JIM LANDON PHOTO



In this well-preserved specimen from a fossil oak, both distinct vessels and rays are visible. A cross section slide can be made from this view.

glued to the slide. Finally, the thin section is carefully ground down so that preserved cell anatomy can be studied. This process is then repeated so that a tangential and radial thin section can also be obtained.

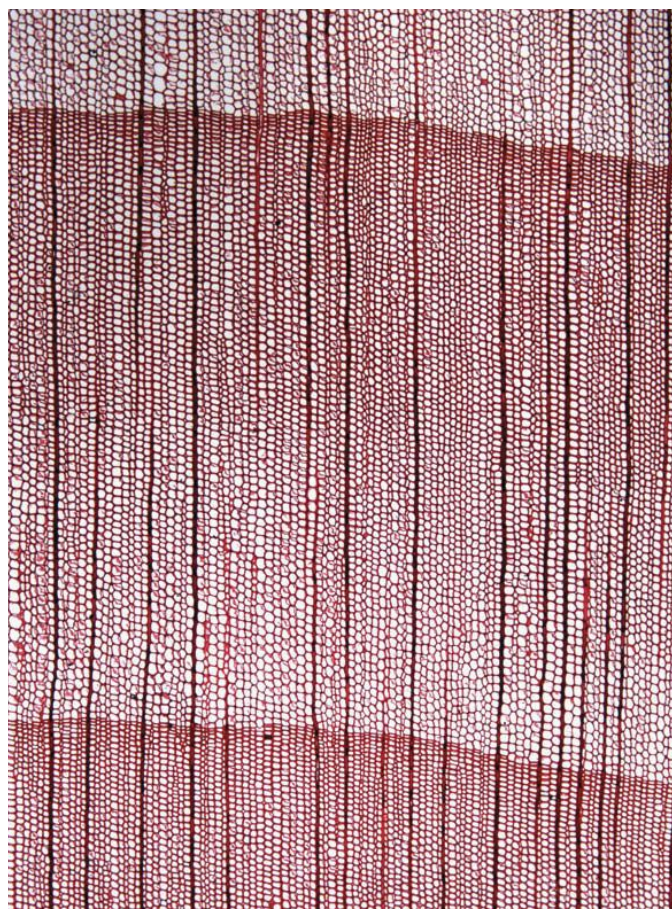
I remember when I used dichotomous keys when working on plant identification in botany classes and how frustrated I got when trying to match the detailed terminology in the keys with flower features I was observing. The process is a real art form that takes years of practice and dedicated study to master. The same is true for identifying the microscopic features of the cells in petrified wood and then using that information to determine genus and species.

Fortunately, with the advent of digital technology and the pioneering work of several dedicated paleobotanists, the process has become far less painful. Elisabeth Wheeler, of the Department of Forest Biomaterials at North Carolina State University, Tad Dillhoff, of The Burke Museum and Evolving Earth Foundation, and others have organized easily accessible online reference keys that are most useful for identifying fossil wood specimens.

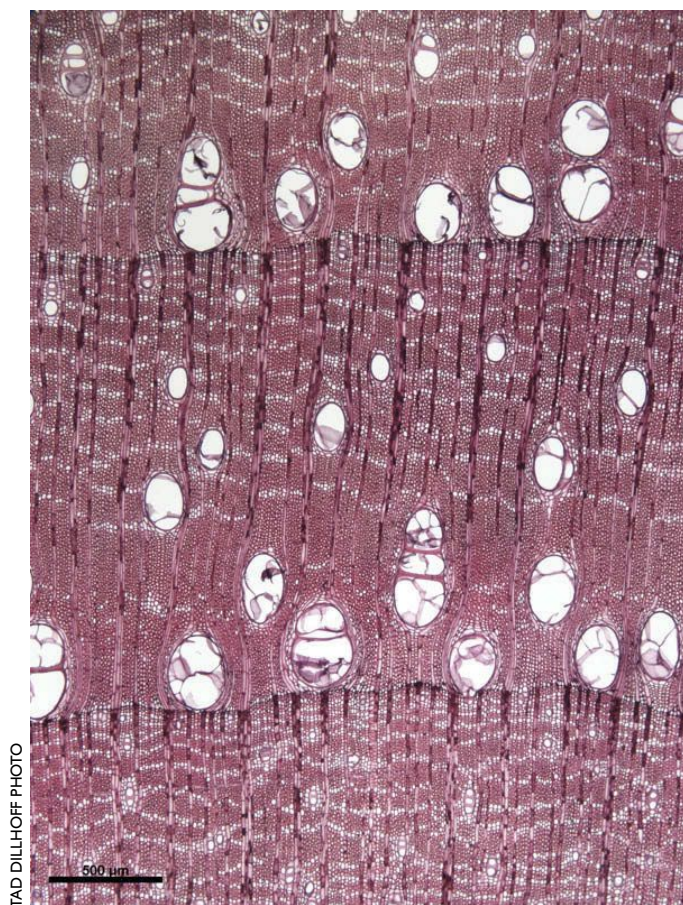
The first reference is called The Inside Wood Database, from the Department of Forest Biomaterials at North Carolina State University (<http://insidewood.lib.ncsu.edu/search>). It is a searchable database that uses multiple ways to access identified thin-section photographs with detailed descriptions of cell anatomy for both modern and fossil wood species. Published by the International Association of Wood Anatomists (www.iawa-website.org), the *IAWA Journal* has a detailed description on how to use the Inside Wood Database (Vol. 32(2), 2011, pp. 199-211). One of the important features of the database for fossil wood species is that it also gives information on the geologic age, formation, and location in which each specimen was found.

To attempt to identify an unknown fossil wood, cross, radial and tangential sections of a specimen are made and a form listing cell descriptors is filled out. This can be a tedious and somewhat overwhelming process if you don't have a background in wood anatomy (like most of us) or if you are attempting to iden-

TAD DILLHOFF PHOTO



This slide of a living species shows the cell structure of a cross section of a typical conifer, which is a gymnosperm.



TAD DILLHOFF PHOTO

Semi-ring porous woods have large spring wood vessels that gradually grade to smaller vessels as the growing season progresses.



TAD DILLHOFF PHOTO

Diffuse porous woods (softwoods) have many similar sized vessels that are scattered uniformly through the growth ring.

tify a specimen with marginal preservation. Fortunately, Dillhoff has developed www.evolvingearth.org/mcabee/fossilwoods/fossilwoodsmain.htm, a Web site that has databases and a pictorial glossary that allows fossil wood rookies to use the Inside Wood Database with practice. It has links to softwood descriptions (www.evolvingearth.org/mcabee/fossilwoods/softwoods.zip) and hardwood descriptions www.evolvingearth.org/mcabee/fossilwoods/hardwoods.zip and a pictorial glossary. The glossary can be accessed through his main Web page.

When an attempt is being made to identify an unknown specimen, several steps are followed to prepare the specimen for potential identification. The first step is to make an initial observation of the specimen to determine if it has visible rings by wetting it and looking at the surface of the cross section. Growth rings will be more evident in species that grew in temperate climates, while those of species that grew in tropical environments will tend to be less distinct.

As in any scientific study, there are always exceptions to the rule. Some fossil woods may be too dark to discern a ring

pattern, so if in doubt, go ahead and prepare a thin cross section to make sure. If nothing shows up, throw it in your tumbler. If a piece does show promise, cut a cross section and observe the cut face with a hand lens to see if any vessels and/or rays can be seen.

For step two, prepare a thin cross section so that it can be viewed under a microscope. I often cut a rectangular piece from the specimen that spans several growth rings because I have found that cell preservation can vary greatly from place to place in a specimen. Once a chunk has been cut from the main piece, smooth the cross section face on a flat lap. I use a diamond lap with first 100 and then 220 grit.

Next, glue the flat face to a glass slide using clear epoxy, making sure that any trapped air bubbles are removed. I make my own slides from single-pane window glass. I also use an epoxy resin called KOA 300 that sets when exposed to UV light. I purchase it online from Kemxert Corp. (www.kemxert.com).

Once the epoxy sets, it is time for the tricky step. Cut the face of the glued piece as close to the surface of the glass slide as

you can without screwing things up. I do this freehand on my Genie using a diamond saw attachment because I don't have a jig. The next step is to return to the flat lap and start grinding the cut face down so that light from the microscope will pass through it.

At this step, I check the cross section frequently to make sure enough material has been removed. I also check to see if the cell structures are becoming distinct enough to see. If not, I discard the slide and either abandon the specimen or try to obtain a new cross section from another place on the specimen. It took nine attempts to finally find a small piece that had adequate preservation on one log I recently obtained. If the cell structure of the cross section looks good, I repeat the process with tangential and radial sections.

Once the slides have been prepared, the fun can start. I make copies of the IAWA data sheet, which I downloaded from <http://insidewood.lib.ncsu.edu>, and go down the list of descriptors, attempting to determine whether the specimen I am working with has the listed feature. This is where one could become quickly discour-

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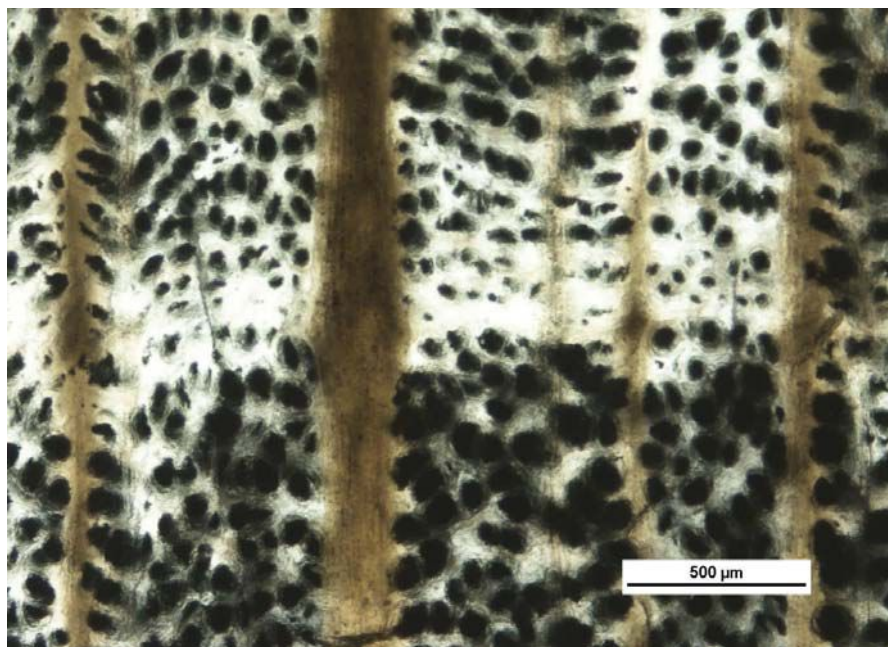
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PETRIFIED WOOD from page 21



JIM LANDON PHOTO

This cross section slide of Miocene age sycamore displays wide, evenly spaced rays and is diffuse porous.

aged were it not for the pictorial information from Dillhoff's glossary and the other information provided in the references from the Web sites listed above.

I have found that, in working with fossil wood, many of the subcellular features that are listed on the data sheet are either not present (due to quality of preservation) or difficult to observe in the specimen. Don't despair! As the saying goes, "Rome wasn't built in a day". Just record

the features you can see and move on.

At the end of the data sheet are questions about the age of the formation the specimen came from. Answering this question is crucial, as it places the specimen in a geologic timeframe. Many fossil wood localities in the United States have been studied in the past, so a little online checking should be able to give you the information you need. Just make sure it is accurate.



JIM LANDON PHOTO

This cross section of a Pliocene oak (white oak type) spans the growth of two years and shows a distinctive ring porous pattern. The cells at the top are from spring wood growth and those at the bottom from the previous summer.



The prepared slides can be studied under the microscope, where specifics of cell anatomy can be determined and recorded on the IAWA data sheet.

Once you have finished filling out the data sheet as completely as possible, enter the information in the search option on the IAWA Web site (<http://insidewood.lib.ncsu.edu>), which will then attempt a match. Here is where things can get a little dicey. The taxonomy (scientific name assignment) of living species is determined by a number of features, which were listed above. With fossil wood, all you have to go on is cell structure. This can lead to a common mistake: assigning a modern name (genus/species) to a fossil species.

For example, if you are working with a specimen of fossil wood that is identified as being from the genus *Quercus*, it could in reality be any one of a number of species from that group. It is also not a good idea to assign the name of a specimen that is from, for example, an early Miocene-age deposit to a specimen that has similar anatomy from a late Miocene or younger age. For the purposes of this article, I think it is best to just let the professionals handle this discussion and give you kudos if you can successfully identify an unknown specimen to the genus level.

I remember vividly the first specimen of fossil wood I prepared while working on my master's degree. It was from a Miocene age oak from the Crookston Bridge Member of the Valentine Formation in Nebraska. When I put it under the microscope for the first time, I was presented with a view that reminded me of the stained glass windows in a gothic cathedral. Such beauty and such detailed preservation was amazing to look at.

Working with fossil wood identification is exciting and can benefit the science community as a whole. Be willing to share what you find with the Facebook groups that specialize in fossil wood and with university researchers in your area who are also interested in fossil wood. There is so much to learn and so few who are currently researching the area. You could be a big help. Good luck! 💎

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THE ROCKS & MINERALS OF POMPEII



A Rockhound's Look at the Ancient Roman City

Story and Photos by Steve Voynick

The ancient city of Pompeii is one of the most tragic and famous sites in antiquity—tragic because of its sudden demise in a massive eruption of the nearby Mount Vesuvius volcano, and famous because archeological recoveries have provided an unprecedented look into the day-to-day life of this first-century Roman city. The traveling museum exhibit “A Day in Pompeii” recently brought a spectacular collection of these artifacts to the United States.



A popular style in Pompeian gold jewelry was to link hollow gold half hemispheres together into bracelets and necklaces.



The volcanic debris that destroyed the city of Pompeii also preserved its art and artifacts, and even some of its residents.



In this fresco, the young woman's hair was painted using hematite for coloring, while the pigment in the older woman's green head is blue azurite that altered to green malachite.

When the exhibit came to Denver, my wife, Lynda, and I spent "a day in Pompeii" as media guests of the Denver Museum of Nature & Science (DMNS). The exhibit brought home the fact that Pompeii's impressive cultural, architectural and artistic achievements were largely dependent upon the availability of many rocks, minerals and metals. These included everything from gold, silver, lead, tin and copper to marble, alabaster, and a host of gemstones and minerals. These came from mines and quarries scattered across—and even beyond—the sprawling Roman Empire.

Some rocks served as sculpting media, while many minerals were ground into pigments for use in paints. Gemstones and other minerals that caught the Roman eye—fluorite, pyrite, carnelian, lapis lazuli, amber, cinnabar and azurite, to name just a few—are still [collected] by rockhounds today.

To fuel their development, Roman cities like Pompeii took vast amounts of rocks and minerals from the earth. And in the end it was rock—volcanic rock—that took Pompeii. Ironically, the volcanic debris that destroyed the city as a result of the Aug. 24-25, 79 CE, eruption also preserved much of the art and many of the personal belongings of its residents.

In the first century, Pompeii was a prosperous commercial center for fishing, agriculture and shipping that was also home to 20,000 residents. The city site is on the west coast of the Italian peninsula, 20 miles southeast of Naples. Just six miles to the northwest of Pompeii, the dominant regional landmark is Mount Vesuvius, an active volcano with a summit elevation that was estimated to be about 7,000 feet at that time.

Pompeii's vibrant economy supported residents of every social and economic stratus, from the impoverished to the affluent. One shared trait among wealthy and middle-class Pompeians was a penchant for decorating the interior walls of their homes with elaborate fresco paintings on plaster substrates.

Roman plaster consisted largely of calcite (calcium carbonate), obtained from seashells or limestone. The powdered calcite was calcined, or roasted into lime (calcium oxide), then mixed with water to create a plaster of slaked lime (calcium hydroxide). After being applied to a wall, the slaked lime converted to recrystallized calcium carbonate in the form of a hard, smooth plaster. Roman plaster also contained a powdered filler material that, in the Pompeii region, was powdered rhyolite, an abundant, silica-rich, volcanic rock.

Roman artists worked with a varied palette of mineral pigment-based paints, which the Roman scholar Pliny the Elder (Gaius Plinius Secundus) categorized as either "florid" or "austere". Florid pigments were costly and intensely colored; austere pigments were inexpensive, "earthy" materials with more subdued hues.

The most widely used austere pigment was finely ground hematite (iron oxide) or "red ochre", which had a rich, red-to-reddish-brown color. "Yellow ochre" was goethite, or basic iron oxide, a yellow-to-brownish-yellow pigment. The preferred austere blue pigment was "Egyptian blue", a calcium copper silicate produced by heating together calcite, metallic copper, and [crushed silica sand].

"Green earth" was a mix of glauconite, a group of complex, micaceous silicates found in marine sediments, and celadonite, a basic potassium iron magnesium silicate. Both minerals are pale green; the glauconites are the coloring agents in the greenish strata of many sedimentary rocks, while celadonite commonly occurs as a lining in basaltic vugs. Another austere green pigment was verdigris (literally "green of Greece"), a copper acetate produced by treating metallic copper with acetic acid.

The most widely used austere brown pigments were the iron oxide- and manganese oxide-rich clays called umber and sienna. Roasting intensified their colors into the dark-brown of "burnt umber" and the reddish-brown of "burnt sienna". White pigments consisted of powdered calcite obtained from chalk, limestone or seashells; black pigments came from lampblack, powdered charcoal, or the ashes of burned bones or ivory.

Florid pigments were much more vivid. Brilliant-red florid pigments included vermillion, which was powdered cinnabar or mercury sulfide, and realgar, or arsenic sulfide. Both were obtained from the mercury mines at Almadén, Spain, and at Idria, in present-day Slovenia. The leading bright-yellow pigments were orpiment, an arsenic sulfide also obtained from Almadén and Idria, and jarosite, a basic potassium iron sulfate from Sierra Almagrera, Spain.

Verdazuro, the copper-carbonate mineral malachite, was the most widely used bright-green pigment; it was obtained from the Mediterranean island of Cyprus and from sites in what are now France and Morocco.

The most popular florid blue pigment among Roman artists was azurite, a basic copper carbonate that is closely associated with malachite. Although azurite-based pigments initially exhibited deep, rich blue shades, most eventually altered into the green shades of malachite. The bright-blue, azurite-based paint that Pompeian artists used almost 2,000 years ago is now, in surviving examples of their art, a somber, forest green.

The premier blue pigment of the Roman era was lazurite, a basic sodium calcium aluminum sulfate chlorosilicate and the primary component of the gemstone lapis lazuli. It was mined only in Afghanistan's Kokcha Valley and obtained via trade caravans from the Middle East. Because it was difficult to extract from lapis lazuli, pure lazurite, later known as "ultramarine", was by far the most costly of all natural pigments—literally worth its weight in gold.

Wealthy Pompeians also adorned their homes with sculptures of all sizes. The preferred Roman sculpting medium was marble, which is metamorphosed limestone, a rock that consists largely of calcite. When subjected to the heat and pressure of metamorphism, limestone takes on a plastic consistency, and eventually recrystallizes as marble.

The purest marble, called statuary marble, is snow-white and has a glittering, crystalline structure and a soft, white glow. The glow is due to calcite's translucency, which enables light to penetrate only a few millimeters into the rock before scattering and reflecting back. This scattering produces a characteristic "waxy" look that imparts a warm, almost lifelike appearance to marble sculptures.

Colored marble forms from the metamorphism of lower grades of limestone, which contain small amounts of noncalcareous minerals. Marble's pink and red colors are caused by hematite; yellows by limonite, an indeterminate mixture of hydrous iron oxides; greens by the serpentine-group minerals; blues by diopside, a calcium magnesium silicate; and shades of dark gray to near black by organic mate-



This 12-inch-high, elaborately embossed, kitchen container was made of lead, a metal that the Romans used extensively, oblivious to its disastrous effect on their health.



Leaded glass, called "paste," was a widely used imitation-gem material throughout the Roman Empire.



Bronze coins were the “pocket change” of the Roman Empire, including Pompeii, and were used in everyday financial transactions.



Bronze valves and taps, along with lead water tanks and pipes, were widely used in Roman plumbing systems.



Large amounts of bronze were cast into a variety of decorative and useful objects, such as this serving tray.

rial that was carbonized during metamorphism. Marble colors can be uniform or patterned, with attractive swirls of color that represent the flow movements of the metamorphosing limestone when it was in a plastic state.

The Romans obtained their marble from Greece before developing their own quarries at Carrara, Massa and Serravezza, in Italy’s Apuan Alps. The best was Carrara marble, which Roman sculptors used extensively. Marble sculptures recovered at Pompeii have the same smoothness and soft glow as when they were made—even after prolonged burial in volcanic ash. Many of the homes of wealthy Pompeians were also decorated with large, exquisitely detailed floor mosaics with intricate designs, created from tens of thousands of tiny, inlaid pieces of colored marble.

Pompeii’s ruins have also yielded many sculptures and vessels fashioned from alabaster, the dense, fine-grained, compact form of gypsum, or hydrous calcium sulfate. Most Pompeian alabaster artifacts are beautifully translucent and have a soft,

honey-yellow color; some exhibit multi-colored, streaked patterns. With a Mohs hardness of only 2.0, alabaster is easily and quickly carved. Despite its softness, however, it takes a lustrous polish and glows like fine marble. Roman sculptors worked with rough alabaster, then heated their finished creations to increase the hardness to nearly that of marble (Mohs 3.0).

The alabaster recoveries at Pompeii included goblets, sculptures, vases, and funerary urns. The Romans quarried alabaster at Volterra and Castellina Maritima in Tuscany, but obtained their finest material from Egypt and what is now Algeria.

Pompeians also loved jewelry. For the wealthy, gold was the ultimate jewelry metal. Romans obtained gold from varied sources throughout their vast empire, but mainly from rich placers in Spain and mines in Britain, Austria and France. It also came through trade from Africa, Arabia and India.

The Romans issued gold coinage and fashioned much of their gold into bracelets, necklaces, pendants, earrings, rings

and brooches. Roman gold jewelry initially copied earlier Greek styles, but soon took on its own distinctive appearance. Classic Roman jewelry of the first century included simple rings set with gemstones, delicately plaited necklaces, hollow gold hemispheres linked into bracelets and necklaces, and popular “coiled-snake” bracelets.

Gold rings, brooches and pendants were often set with gems or gemlike materials. These included pearls from the Persian Gulf, lapis lazuli from Afghanistan, blue sapphire and yellow topaz from India and Ceylon (now Sri Lanka), peridot and the emerald variety of beryl from Egypt, and the aquamarine variety of beryl from Afghanistan and Ceylon.

The most common gems in Pompeian gold jewelry are considered semiprecious stones today: the red, garnet-group gemstones, and carnelian, the red subvariety of microcrystalline quartz. Romans obtained garnet from the metamorphic regions of the Alps, and carnelian from the African and Arabian deserts, as well as from what is now southern Germany. Garnet and car-



This 5-foot-wide mosaic floor section, recovered from a Pompeii home, contains about 5,000 pieces of inlaid, multicolor marble.

nelian gems were often carved into intaglio and cameo forms.

Artifacts of amethyst, the purple variety of quartz, are also found amid the Pompeii ruins. The word “amethyst” stems from the Greek *amethystos*, literally meaning “remedy against drunkenness”. This is a reference to the Greek and Roman beliefs that the stone prevented intoxication.

When drinking wine—which they did copiously—Romans often wore amethyst jewelry or amulets to protect them from becoming inebriated. Some even drank from amethyst goblets, believing that, because the goblets retained their purple color after the wine was consumed, the intoxicating effects remained within the goblet. Purple fluorite was thought to have similar powers when used in this manner.

Interestingly, Pompeii was a large producer of wine, much of which was consumed by its residents. However, the quality of the local wine, according to Roman author Pliny the Younger (Gaius Plinius Caecilius Secundus), was decidedly lacking and had deleterious effects. Perhaps the oenophiles of Pompeii drank enough of



Funerary urns of alabaster and glass somehow survived their own burial in volcanic ash.



A 12-foot-high display shows the actual depth of the stratified volcanic debris that buried Pompeii.



Carved trinkets of alabaster, amber, and other materials often served as funerary offerings in ancient Rome.

their local wine to require the help of both amethyst and purple fluorite.

The most distinctive fluorite artifacts recovered at Pompeii are made from "Blue John", a blue-, purple- and yellow-banded variety that the Romans mined in Cornwall, Britain, in the far reaches of the empire. Because of its rarity, Blue John was very costly and was worked only by the finest craftsmen. The exquisite vases and urns carved from multicolor, translucent Blue John fluorite are among the most beautiful of all Pompeii artifacts.

Roman craftsmen also cleaved fluorite crystals into octahedrons, perhaps as a simple, de facto form of faceting. Smooth cleavage faces provided intriguing "windows" into the transparent-to-translucent, fluorite octahedrons, while the sharp edges and octahedral symmetry fascinated the Romans. Fluorite octahedrons were popular funerary offerings and were drilled and strung in necklaces.

The gleaming, perfectly shaped pyrite cubes from Navajún, Spain, which are familiar to every modern mineral collector, also appealed greatly to the Romans. In Pompeii, Navajún pyrite cubes were used as a mosaic-inlay material and served as funerary offerings.

Many of the artifacts found at Pompeii consist of amber from Baltic Sea beaches. Romans maintained the *Via dell'Ambr*a (the "Amber Route") as an important amber-trade corridor between the Baltic region and Rome. The Roman historian Cornelius Tacitus wrote that amber was so plentiful on the Baltic beaches that the people of that region could not understand why the Romans would actually pay for it. In Pompeii, amber was carved into figurines and strung into necklaces.

Glass artifacts are also common at Pompeii. The Romans made glass from silica, flux, and a stabilizer. The silica was beach sand containing small amounts of lime, which served as a stabilizer to decrease solubility. The flux, which lowered the silica's melting point, was the mineral natron, or sodium carbonate, obtained from Egypt's Wadi El Natrun evaporite deposits. Most Roman glass had a natural, pleasing "aquamarine" color.

During the first century, newly developed glassblowing techniques made possible the rapid production of thin-walled glass vessels in virtually any shape. Many beautiful, blown-glass vases and urns have been recovered at Pompeii.

Roman glassmakers also produced high-refraction glass by adding lead oxide, obtained from lead smelters, to the glass mix. By substantially increasing glass density without compromising transparency, lead oxide greatly increased the refractive index of glass and thus its brilliance and "sparkle".

Leaded glass, called "paste", served as an imitation gem material. Oddly enough, however, inexpensive paste gems, usually in the forms of cabochons, intaglios and cameos, were often set into gold jewelry. Archeologists suggest that, to the Roman eye, the luster of imitation, leaded-glass gems may have actually surpassed that of the real gemstones that were then available. Most paste was fashioned into beads for use in the bracelets and necklaces that were the era's inexpensive costume jewelry. The Pompeii ruins have yielded many beautiful necklaces of etched, aqua-colored paste beads.

Other metals that were important to life in Pompeii were silver, lead and bronze (a copper-tin alloy). Silver was the primary



This 15-inch statue of the Roman muse Polyhymnia is carved in marble, the preferred medium of Roman sculptors.



"Coiled-snake" gold bracelets were quite popular among Pompeii's wealthy residents. One bracelet bears the engraved name of its owner.



Recovered from the ruins of Pompeii, this detailed bronze casting depicts Sabazius, the Roman god of fertility, surrounded by symbols of regeneration.

Roman coinage metal, while bronze coins were used for everyday financial transactions. Silver was also fashioned into plates, tableware and jewelry, while large quantities of bronze were cast into an array of functional and artistic objects.

The Romans made great use of lead. With its low melting point and great workability, lead was easily fashioned into kitchen utensils, roofing sheets, and floor tiles, along with the pipes, tanks, and other fixtures of the extensive Roman water systems.

These metals came mainly from the mines of Britain, Spain and Cyprus. Silver and lead were mined together from argentiferous-galena ores. The huge Roman silver-lead smelting industry lasted for more than 400 years and its environmental impact can still be traced today. By studying drill cores taken from the polar ice cap, scientists can measure historic atmospheric conditions and date major pollution events. Ice-core studies show that global atmospheric pollution by lead, arsenic and sulfur compounds soared during the peak centuries of Roman lead-silver smelting.

The massive use of lead by the Romans also had a more immediate impact. Medical studies of Roman bones recovered from Pompeii and elsewhere reveal blood-lead levels substantially higher than those deemed toxic today. It is likely that these levels of lead poisoning would have caused health problems ranging from male sterility to mental instability—conditions that some researchers suggest may

have contributed to the eventual downfall of the Roman Empire.

Any discussion of the rocks and minerals of Pompeii would have to include the enormous volume of volcanic rock, ejected from Mount Vesuvius, that destroyed the city. Mount Vesuvius is a composite volcano (stratovolcano) built of explosively erupted, pyroclastic materials interspersed with non-explosively erupted lava flows and volcanic debris. Vesuvius had erupted many times in prehistory, and major earthquakes in 62 and 64 had already seriously damaged the city.

From the writings of Pliny the Younger and the current research of geologists and volcanologists, we know that Mount Vesuvius erupted suddenly at about 1 p.m. on Aug. 24, 79. As a thin layer of ash quickly fell on Pompeii, a dark cloud of ash and steam soared 50,000 feet into the sky. By midafternoon, many residents began to flee as a mix of white pumice (light, granular volcanic glass), lapilli (small, stony or glassy pyroclastic fragments), and ash began covering the city. By evening, Pompeii was covered in 5 feet of volcanic debris.

At midnight, when the eruptive cloud had soared more than 100,000 feet and the city lay beneath 9 feet of debris, masses of steamy ash began flowing through Pompeii, collapsing roofs and walls. The eruptions subsided at dawn on August 25. But as the remaining residents attempted to flee, massive pyroclastic surges of steamy, scalding ash engulfed and suffocated them and completed the destruction of the city.

When the eruptions finally ended later that morning, the upper 3,000 feet of Mount Vesuvius had been blown away and Pompeii was buried under 12 feet of stratified volcanic debris.

The bottom of the heavily compacted debris is a foot-thick base layer of lava pebbles that is covered by 5 feet of granular, white pumice. Atop this is a 3-foot-thick layer of gray pumice, then a foot of small rocks and volcanic sand, and finally a 2-foot-thick layer of ash and small rocks.

Most of the estimated 2,000 deaths at Pompeii occurred during the final pyroclastic surges of scalding ash. The hot, wet material encased bodies as they fell, preserving in stark detail body forms, clothing folds, and sometimes even facial features. Over a long period of time, these bodies decomposed completely, leaving only empty cavities in the hardened ash.

In 1860, shortly after archeological studies of the ruins had begun, Italian archaeologist Giuseppe Fiorelli poured plaster into some of these lithified-ash molds. After the plaster set, Fiorelli chipped the ash away to expose remarkably detailed casts of humans and animals at the moment of their deaths.

Today, these haunting body casts add a tangible element of human tragedy to the wealth of artifacts that has been recovered from Pompeii's ruins. From its life to its sudden death, Pompeii is an epic story of rocks, minerals and metals as they impacted first-century Roman life. 💎

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31-2—PRESCOTT VALLEY, ARIZONA: Annual show; Prescott Gem & Mineral Club, Prescott Valley Event Center; 3201 North Main St.; Fri. 9:00 am-5:00 pm, Sat. 9:00 am-5:00 pm, Sun. 9:00 am-4:00 pm; Adults \$5.00, Seniors \$4.00, Students \$4.00, Children under 12 yrs free!; 12th annual Prescott Gem & Mineral Show. Minerals, fossils, meteorites, slabs, tools, jewelry, exhibits and demonstrations. Hourly raffle drawing for valuable prizes. Child friendly demonstrations, displays, games, face painting, geode cracking, spinning wheel, fluorescent rocks and minerals. Currently all spaces for vendors are filled at this time. New vendors will be added to our waiting list.; contact Prescott Gem & Mineral Club Attn: Melanie, P.O. Box 3923, Chino Valley, AZ 86323; Web site: www.prescottgemmineral.org

August 2015

1-1—ISHPEMING, MI, MICHIGAN: Annual show; Ishpeming Rock and Mineral Club, Ishpeming Elks Club; 597 Lake Shore Dr. ; Sat. 9:30 am-4:30 pm; Admission is Free; 2014 show information AUGUST 2nd, Ishpeming, Michigan: Ishpeming Rock and Mineral Clubs 39th Annual Gem and Mineral Show, Ishpeming Elks Club, 597 lake Shore Dr.; Saturday 9:30-4:30; Free admission; kids' area, silent auction, hourly prizes, raffle, demonstrations, dealers; Cracker Barrel session Saturday evening at 7pm; live mineral auction, raffle, program; Mineral field trips Fri., Aug 1, and Sun., Aug 3; Contact Ernest Johnson, 1962 W. Fair, Marquette, MI 49855, 906-228-9422; e-mail: ejohnson@nmu.edu Ernest Johnson, Show Chairperson Ishpeming Rock and Mineral Club 1962 W. Fair Marquette, MI 49855 906-228-9422 ejohnson@nmu.edu ; contact Ernest Johnson, 1962 W. Fair, Marquette, MI 49855, (906) 228-9422; e-mail: ejohnson@nmu.edu; Web site: www.ishpemingrocks.org

7-9—WEST SPRINGFIELD, MASSACHUSETTS: Wholesale and retail show; Martin Zinn Expositions, L.L.C., Eastern States Exposition - Better Living Center; 1305 Memorial Dr.; Fri. 10:00 am-6:00 pm, Sat. 10:00 am-6:00 pm, Sun. 10:00 am-5:00 pm; Adults \$6.00, Children are Free!; Huge air-conditioned hall with over 200 vendors in retail and wholesale (registration required) sections. Free lectures by popular speakers, free mineral identification, free mineral samples for all kids, and hourly door prize drawings. Also available for a small fee are sluice-panning for gems or fossils, and geode

cracking. Fine minerals, fossils, gems, jewelry, beads, meteorites, lapidary supplies and decorator items in all price ranges.; contact Regina Aumente, PO Box 665, Bernalillo, NM 87004, (505) 867-0425; e-mail: mzexpos@gmail.com; Web site: http://www.mzexpos.com/east_coast.html

7-9—HOUGHTON, MICHIGAN: Annual show; Copper Country Rock and Mineral Club, Houghton Elementary School; 203 W Jacker Street , (Corner of Bridge and Jackson Streets); Fri. 1:00 pm-8:00 pm, Sat. 10:00 am-6:00 pm, Sun. 11:00 am-3:00 pm; Admission is Free; Past events have included geode cracking and metal detector use for children.; contact Norm Gruber, (906) 228-6764; e-mail: pres@ccrmc.info

7-9—PLEASANTON, CALIFORNIA: Wholesale and retail show; Gem Faire Inc, Alameda County Fairgrounds; 4501 Pleasanton Ave; Fri. Noon-6 pm, Sat. 10am-6 pm, Sun. 10 am-5 pm; Students, Adults + Seniors \$7, Children ages 0-11 are free!; Fine jewelry, precious & semi-precious gemstones, millions of beads, crystals, gold & silver, minerals & much more at manufacturer's prices. Exhibitors from around the world. Jewelry repair & cleaning while you shop. Free hourly door prizes. ; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: <http://www.gemfaire.com>

8-9—RICE LAKE, WISCONSIN: Annual show; Northwest Wisconsin Gem & Mineral Society, Barron County Fair Grounds; Hwy. 48 North; Sat. 10:00 am-5:00 pm; Admission is Free!; Gems, jewelry, beads, minerals, fossils, rocks, lapidary equipment and supplies, jewelry-making and wire wrapping demonstrators, polished rocks, geodes, crystals. ; contact Roy Wickman, 1127 7th St, Almena, WI 54805; e-mail: rktswick@chibardun.net

8-9—EDMONDS, WASHINGTON: August Sale; Maplewood Rock and Gem Club, Maplewood Rock and Gem Clubhouse; 8802 196th St; Sat. 9 am-5 pm, Sun. 10 am-5 pm; Admission is Free; vendors welcome; contact Bev Ryder, (425) 338-4184; e-mail: famryd@aol.com

8-9—WALNUT CREEK, CALIFORNIA: Show and sale; Pacific Crystai Guild, Civic Park Community Center; 1371 Civic Drive; Sat. 10:00 am-6:00 pm; Adults \$8, Children are Free!; Get ready for THE SUMMER CONTRA COSTA CRYSTAL FAIR which includes a magical mix of crystals, minerals, beads, and jewelry. Whether it's stone beads from Nepal, amethyst geodes from Madagascar, jade from China, or jewelry from northern California artisans -you'll find it at the Crystal Fair at below market prices. You'll also find an aura camera, tarot reader, sound healer, massage therapist, reiki master and many others - 30 booths in all. The exact location is the Civic Park Community Center at 1375 Civic Drive at Broadway in Walnut Creek. The hours are 10am to 6pm on Saturday, August 8; and 10

am to 4 pm on Sunday, August 9. Admission is \$8 (under 12 free). There is plenty of free parking and the downtown Walnut Creek BART station has a shuttle to Civic Park. For info: Jerry Tomlinson at (415) 383-7837. ; contact Jerry Tomlinson, PO Box 1371, Sausalito, CA 94966, (415) 383-7837; e-mail: jerry@crystalfair.com; Web site: www.crystalfair.com

14-15—TAHLEQUAH, OKLAHOMA: Annual show; Tahlequah Rock & Mineral Society, Tahlequah, OK; 300 W. First St; Fri. 9:00 am-6:00 pm, Sat. 9:00 am-5:00 pm; Adults \$3.00 18 and over; Fluorescence and other Educational displays, Silent auction, Demonstrations, Children's Games, Door Prizes and Snack Bar.; contact Sara Brasel, 14236 Cross Timbers Rd, Tahlequah, OK 74464, (918) 284-5770; e-mail: rockhound-sally@aol.com; Web site: tramsok.webs.com

14-16—SACRAMENTO, CALIFORNIA: Wholesale and retail show; Gem Faire Inc, Scottish Rite Center; 6151 H St; Fri. Noon-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Students, Adults + Seniors \$7, Children ages 0-11 are free!; Fine jewelry, precious & semi-precious gemstones, millions of beads, crystals, gold & silver, minerals & much more at manufacturer's prices. Exhibitors from around the world. Jewelry repair & cleaning while you shop. Free hourly door prizes. ; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: <http://www.gemfaire.com>

14-16—PORT TOWNSEND, WASHINGTON: Annual Rock and Gem Show in conjunction with the Jefferson County Fair; Port Townsend Rock Club, Jefferson County Fairgrounds; 4907 Landers Street; Fri. 10 am-9 pm, Sat. 10 am-9 pm, Sun. 10 am-6 pm; Admission is Free for show, -- fair has gate fees; Fair admission gate prices Adults - \$6 Seniors (65+) - \$5 Students (13 - 17) - \$5 Children (6 - 12) - \$2 Age 5 and under - free Three-day Season Tickets include Sunday's Beef BBQ in Advance \$13 at gate \$15 ; contact Garnett Brooks, (360) 379-5531; e-mail: garnett@email.com

14-16—GRAND RAPIDS, MICHIGAN: Faceting Seminar; Midwest Faceters Guild, Tallmadge Township Hall ; O-1451 Leonard NW; Fri. 4:30 pm-8:00 pm, Sat. 8:30 am-5:00 pm, Sun. 8:30 am-5:00 pm; Admission = see information; Learn to Facet - classes in beginners - all equipment furnished - Advanced - bring your machine and rough and we will assist you with new techniques and designs - GemCad - a computer aided software for gemstone designs. - Need to bring a laptop. Price for beginners class and GemCad is \$95.00 - Advanced classes are \$50.00 - Information packets will be mailed upon request.; contact Barb Yost, (616) 254-9777; e-mail: barbandben@gmail.com

14-16—SEASIDE, OREGON: Annual show; Jean Miller, Seaside Convention Center; 415 1st Ave.; Daily 10 am-6 pm;

continued on page 74

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ROCK SCIENCE

by STEVE VOYNICK

Trinitite from Trinity Site

Among the fascinating exhibits at the Bradbury Science Museum in Los Alamos, New Mexico, is a collection of trinitite specimens. Trinitite is the glass-like material that formed on the desert floor at Trinity Site, 60 miles north of Alamogordo, New Mexico, during the July 16, 1945 test of a plutonium-implosion atomic bomb that was the culmination of the United States government's top-secret Manhattan Project.

Trinitite is composed primarily of fused quartz, with lesser amounts of alkali and plagioclase feldspars, hornblende minerals, and pyroxene minerals—an indefinite composition that is somewhat similar to that of natural volcanic glass, obsidian. Trinitite, which is mildly radioactive, is also known as "atom-site" and "Alamogordo glass".

Scientists initially believed that trinitite was sand that had melted from the 3,000°F radiant heat of the atomic blast. But in 2005, Los Alamos National Laboratory researchers revised that theory, now believing that trinitite was created from quartz sand that was drawn up into the atomic fireball, then rained down in molten form.

Trinitite has a vesicular structure, with "bubbles" of varying sizes. Most trinitite is pale green; rare black trinitite contains iron from the melted steel of the detonation tower and red trinitite contains copper from melted wires and cables. Trinitite "pearls" formed when spherules of molten silica solidified before falling to the ground.

Trinitite was a very popular collectible in the 1950s, both as specimens and as cleverly marketed "atomic jewelry". Because trinitite still retained a substantial level of its radioactivity at that time, such creations as "atomic earrings" proved to be aptly named because prolonged wear actually caused radiation burns of the earlobes.

The supply of trinitite effectively dried up in 1953, when the U.S. Atomic Energy Commission bulldozed Trinity Site. Today, public access to the site is limited and collecting trinitite is prohibited.

Because it is easy to produce a mildly radioactive, vesicular, glass-like, green silica, trinitite has been widely faked. A genuine specimen, however, emits a characteristic radiation "signature" that clearly reveals its origin in a plutonium detonation.

Plutonium is a transuranic element, and the material in the Trinity Site test was produced by bombarding uranium-238 with neutrons. Most of the Manhattan Project's



A specimen of trinitite from the Bradbury Science Museum in Los Alamos, New Mexico.

original uranium came from the Belgian Congo's Shinkolobwe mine, which produces unusual and colorful specimens of copper, cobalt and uranium minerals.

Discovered in 1915, the Shinkolobwe copper-cobalt-uranium deposit was originally mined for uranium as a source of the rare, radioactive element radium. The mine, by far the richest uranium source ever found, closed in 1939—just as World War II was looming and physicists worldwide were realizing the feasibility of building atomic weapons.

Belgian mining engineer Edgar Sengier, astutely foreseeing the coming strategic importance of uranium, secretly shipped 1,200 tons of uraninite ore to the United States. A single ton of that ore, which graded a remarkable 65% uranium oxide, contained about 1,100 pounds of elemental uranium. When Manhattan Project directors began a desperate search for uranium in 1943, they were surprised and greatly relieved to learn that 1,200 tons of the world's richest uranium ore was already sitting in a warehouse in New York's Staten Island.

The road from Shinkolobwe to Trinity Site, and from uraninite ore to trinitite, was paved with landmark events in history and science. Trinitite specimens, which may or may not be the real thing, are still available for anywhere from \$5 to \$50 per gram. They are a fascinating reminder of that day in July 1945, when Trinity Site hosted the dawn of the Atomic Age. ♦

Steve Voynick is a science writer, mineral collector, former hardrock miner, and the author of books like *Colorado Rockhounding* and *New Mexico Rockhounding*.



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THE TUSCARORA MITER SLIDE



The Tuscarora Miter Slide consists of a vise, slide and stabilizer, which are mounted on a grinder.

The Key to Perfect 45° Miter Joints

Story and Photos by Douglas Klieger

In the lapidary world there are many difficult tasks, and forming a perfect 45° miter joint is certainly one of them. Such joints can be made by hand, but at a tremendous cost in time and effort. There is one commercial device for small-scale grinding of miters; however, it is quite expensive, particularly because it must be attached to an expensive trim saw accessory, and then to and even more expensive grinding/sanding machine. All in all, the commercial system is approximately \$2,000. The only other approach would be to use commercial stone-cutting routers, whose cutting bits start at about \$350.



Small (3 inches by 2.25 inches by 2 inches) boxes are the best projects for first-timers in terms of cost, ease of correcting errors, and ease of polishing.



A small box of green aventurine is a good choice for those with more experience.

After two years of experimentation, I realized that ordinary lapidary saws would not work, and a rock vise suitable for a flat lap would require a machine shop to build. Cylinder or spool grinders, which are, widely used in the stained glass world, would work if a suitable vise could be built. Ultimately, I decided to build a device



TOOLS

Hacksaw with a fine metal-cutting blade
Drill and bits
Countersink bit
Files
Drill press
Jigsaw
Vise



MATERIALS

All-aluminum angle, type 6063-T52
One 1½-in. angle aluminum, ⅛-in. thick, square inside corner, 3-in. long
One 2-in. aluminum flat bar, ⅛-in. thick, 2-in. length
One ½-in. aluminum flat bar, 1-in. length
One ½-in. aluminum angle, ⅛ in. thick, square inside corner, 4 in. long
Six 1-in., 6-32 flat-head bolts and nuts, stainless steel
Two 1-in., 8-32 flat-head bolts, stainless steel
Six 1.5-in., 8-32 hexhead bolts, stainless steel or nylon
One 8-32 threaded rod, stainless steel preferred, 4 in. long or four rods 12 in. each
Eight 8-32 wing nuts and two 8-20 wing nuts
Two T-handle drawer pulls (8-32 thread is the U.S. standard)
Note: The aluminum angle and flat bar are available at most home supply and full-service hardware stores. Aluminum and other metals in stock shapes are available online.

that would make excellent miters at a reasonable cost and share the results with fellow lapidaries. I have named the movable vise that came from this development effort the Tuscarora Miter Slide.

The design of the miter slide rests on a bit of geometry. Any angle iron made of aluminum provides a natural 45° surface if it has equal sides and is placed on a flat surface with the 90° angle at the top. When it is secured to the table surface of a grinder, a natural rail is formed. Placing another length of angle aluminum on top of the rail creates a slider.

A vise can be added by attaching two 1.5-inch angle aluminum pieces to the slider at each end. An aluminum bar between the end pieces forms a clamp to hold the stone slab, or work piece, you're working with.

The tools and materials needed to build the miter slide are basic, and the necessary mechanical actions are few. The slider is complete when holes have been drilled and nuts and bolts inserted to lock the slider components solidly. The rail and slider are attached to the grinder top by positioning bars on the grinder top and flanges on the underside of the rail. The dimensions of the grinder top I used are 10⅞ inches by 9 inches.

BUILDING THE MITER SLIDE

Building the device is simply a matter of cutting, drilling and deburring all the parts. For smooth operation, all holes in the rail and in the slider must be countersunk.

Make the rail from an 18-inch length of 1¼-inch by ⅛-inch angle. Drill two holes positioned 2⅞ inches and 3⅛ inches from one end and ⅜ inch from each edge. Repeat at the opposite end. These holes must match the holes in the brackets.

The slide is an 8-inch length of 1¼-inch by ⅛-inch angle. Drill four holes that are 1 inch from each end and ⅞ inch from the bottom edge.

The stops are two 2-inch lengths of 1 1/4-inch by 1/8-inch angle. In each, drill two holes 1 inch from the end and 7/8 inch from the bottom edge. These four holes and the four holes in the slide must align.

For the brackets, use two 2-inch lengths of 1 1/4-inch by 1/8-inch angle. In each, drill one hole 1/4 inch from the end that fits at the apex of the rail and 1 inch from the apex of the bracket. Drill another hole 1 inch from the end that fits at the apex of the rail and 1/4 inch from the apex of the bracket. Note that, when attached to the rail, the Brackets face each other.

The stiffeners are made from four 12-inch lengths of 1/2-inch angle. Drill two 1/8-inch holes on the same face in each stiffener, centered and placed 1/2 inch from each end.

The horizontal positioning bar is a 6-inch length of 2-inch by 1/8-inch flat bar. Drill two 1/4-inch holes 1 1/2 inches from each end and 1 inch from each side. Enlarge each hole to a 1-inch by 1/4-inch rectangular slot.

The vertical positioning bars are two 4-inch lengths of 2-inch by 1/8-inch flat bar. In each, drill one 1/4-inch hole 3/4 inch from the inside edge and 2 inches from the end. Enlarge each hole to a 2-inch by 1/4-inch rectangular slot. The slot should be 3/4 inch from the edge that is in contact with the rail.

For the vise top, use an 8-inch length of 1/2-inch flat bar. Drill two centered holes 1 inch from each end.

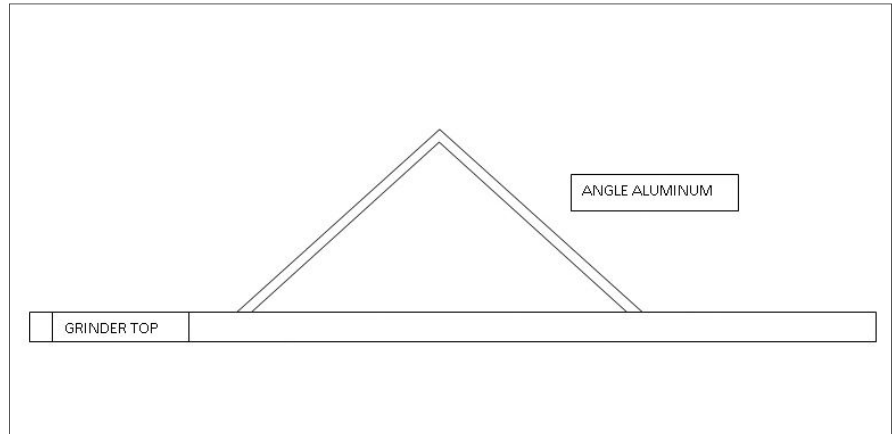
The stiffener connections are four 12-inch lengths of 8-20 threaded rod.

The order of pre-assembly is not critical; just be sure that lengths are accurate, square and deburred.

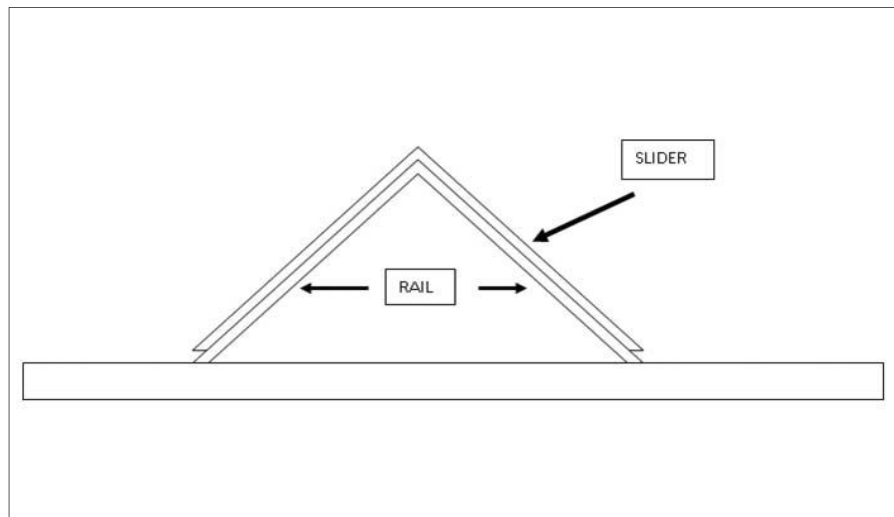
Rectangular slots are cut in each of the flat positioning plates. These plates can be adjusted perpendicular to the rail. Therefore, the left-plate slots are perpendicular to the long axis of the plate. The two-right plate slots are parallel to the long axis. It is essential that all slots can be aligned with the grinding table grid. With some tables, it may be necessary to drill holes for the slot bolts, and these must be aligned with care.

The rail requires a holding bracket near each end, which serves to prevent rail movement. When used with my grinding table, the brackets are attached under the rail so that one side is flush against the edge of the table and the other is flush to one side of the rail. Alignment of the brackets is important. Different grinder tables may require different brackets. The principle is the same: anchor the rail to the grinder.

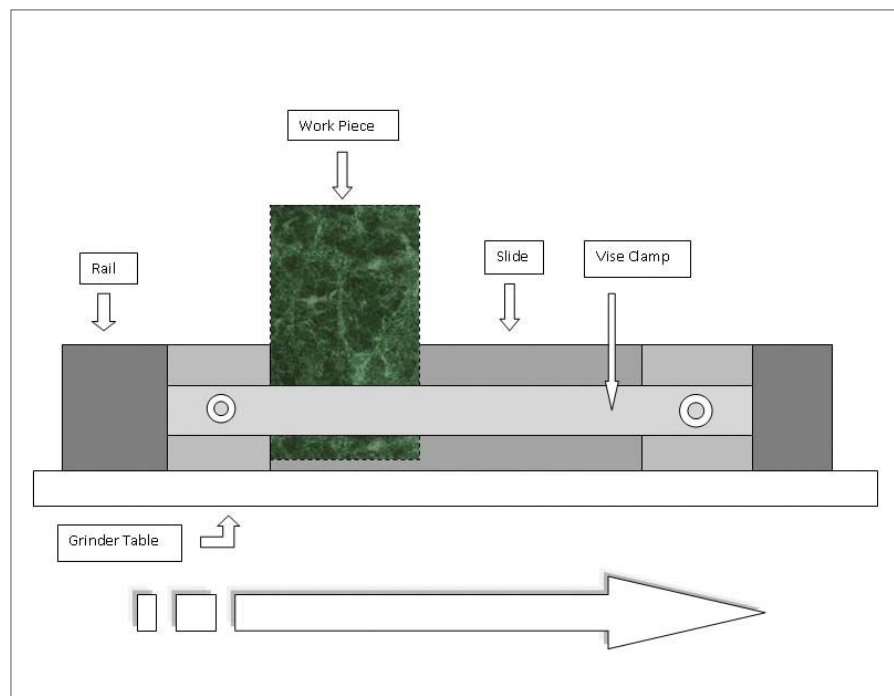
With the positioning bars and rail in place, the next step is to assemble the slider. I chose to make an 8-inch slider matched to an 18-inch rail. The slider has three components made from the 1.5-inch angle aluminum: the 8-inch base and two 2-inch end stops. The fourth compo-



Secure an aluminum angle iron to the table surface of a grinder with the 90° angle at the top.



Place another length of angle aluminum on top of the rail to create a slider.



An aluminum bar between the end pieces forms a clamp to hold a stone work piece.



The rail and positioning bars should form 90° angles with the sides of the grinder table.



The positioning bars hold the rail, with the slide on top, in place.



Placing a work piece under the clamp bar completes the miter setup.

ment is the 0.5-inch flat bar that makes the top half of the vise. Place the 8-inch angle on the bench, apex up, which is the same orientation as the rail. The two 2-inch angles (stops) fit over the slider base at each end.

Affix the stops to the slider base with 1-inch 8-32 bolts on the left side at both ends. Supplement the bolts' holding power with a small amount of epoxy between the slider base and the stop.

Affix the right side of the slider base with 1-inch 8-32 bolts that also go through the vise top bar. Use nuts on the left-side bolts and wing nuts or "T"-style drawer pulls (cabinet handles) on the right-side bolts. With use, you may find that the bolts that provide the clamping force spin in their recesses. A drop of epoxy or cyanoacrylic glue will prevent this.

When all the pieces have been cut and drilled, the final assembly is a simple matter of fitting position plates to the grinder top with hex bolts and nuts. The three layers of the slide use 8-32 flathead bolts, as do the brackets on the underside of the rail. You may find, as I did, that the brackets are not sufficiently rigid. A little epoxy between the bracket and the underside of the rail will solve the problem.

If your grinder top is rectangular, the rail and positioning bars should form 90° angles with the sides. Though geometrically the rail could be aligned at any angle to the grinder and function correctly, this is inadvisable. In short, the rail must not move during operation, and a square alignment is most likely to remain in place.

After using the miter slide on several projects, I have noticed that some miters developed a "hill and valley" pattern along the face of the miter. If this pattern does not affect the edges of the miter, then it is of no consequence. If it does, however, you will need to figure out the cause. What I found was that the grinder was flexing during the operation, causing the head to exert uneven pressure against the work piece.

The grinder can be stiffened by placing two 1/2-inch angles along two sides of the grinder top, paired with two 1/2-inch angles along the corresponding bottom of the grinder. These are then connected with 1/2-inch threaded rods and tightened firmly. The result is a grinder that is resistant to distortion. Similar stiffening may be necessary for the grinding head and motor assembly. Ideally, the grinding head should remain vertical.

Experience also made it clear that wing nuts on the vise/clamp were not a good choice; No. 6 and No. 8 wing nuts are simply too small for comfortable use. The solution I found was to substitute T-style drawer pulls. Most pulls have a standard 8-32 thread. This adjustment also provides a better grip when using the miter slide.

USING THE MITER SLIDE

The Tuscarora Miter Slide is straightforward to use. A vigorous water supply is needed; however, few grinders have sufficient power to execute a miter in one pass. You can speed up the process by removing the “nose” or corner of the work piece with a rough grinding wheel. I use a grinding wheel made of six tile saw blades “ganged” together on a single arbor.

The work piece should be pre-formed so that it has two flat and parallel sides, and edges that are square. To operate the slide, the work piece is mounted on it with a straight and square side against the trailing edge of the vise.

The vise-clamping bar is then tightened fore and aft. Some materials may need a “rubber” pad between the vise bar and the work piece. Position the edge to be mitered so that the grinding drum surface is fully engaged. The ideal grind is 1 mm or less.

After the rail and slide are aligned, move the flat positioning bars against the rail. It is quite important that the rail alignment is exactly perpendicular to the drum. Tighten the positioning wing nuts and then check the rail alignment with a good ruler or caliper. With material that is $\frac{1}{8}$ -inch to $\frac{1}{4}$ -inch thick, a single rail positioning is generally sufficient. Thicker material may require re-positioning the rail.

Using a diamond drum with 60 to 100 grit is best. Slide the mounted work piece slowly into the grinding head with even pressure. Press the slide down and away from the head during the pass. Depending on the individual grinder and work piece alignment, the miter should be complete after a few passes. Occasionally, the work piece will need to be moved forward toward the grinding head for removal of more material.

Drums are available in grits up to 600, although changing drums is not a quick operation and, in my experience, requires a gear puller. Things to watch for are an axial tilt of the drum/motor system, chipping of material due to speed and heating, allowing the slide to become misaligned as it travels past the drum, and hidden flaws in the slab.

Another common problem is controlling end run-out. Just as with a woodworking router and joiners, the tendency is to allow the work piece to move at the end of a pass. Slowing and applying pressure away from the grinding drum at the end of a pass will solve this problem.

BOX MAKING

In box making, all sides must be the same thickness or the miter joint will mismatch on the inside. Small differences in the height of each box side can be corrected after assembly, but only at a considerable risk of edge gouges and edge



Setting the miter slide and waterproof grinder in a plastic paint tray will help with spray control.

tapers. It goes without saying the each pair of box sides must be the same in the horizontal dimension or the box will not be square.

I routinely do the final polishing after assembly because there is always some glue to be removed, and removal frequently causes minor scratches. Also, common agate and obsidian will produce very sharp edges, and the corner where the two 45° edges meet will need some rounding.

In addition to its use in box making, the Tuscarora Miter Slide, with the several positioning bars, makes an excellent tool for making square and plumb edges on lapidary slabs. Simply remove the slider and rail, then adjust either the short positioning bars or the long positioning bar to act as a guide for the work piece. Do not use the short and long bars at the same time.

All considered, the slide is an economical, yet precise, tool for creating shapes and corners in traditional lapidary materials. 💎

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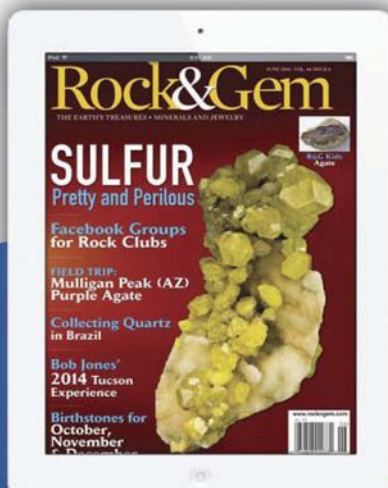
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Celestite

Celestite has also been referred to as celestine, so in mineral guide-books you may find it under one or both names. Scientifically, it is a sulfate salt of strontium, or strontium sulfate (SrSO_4). It is the most common strontium mineral. It grows in well-formed orthorhombic crystals that are sometimes tabular. These crystals are vitreous (glassy) and range from transparent to sub-translucent. They may be colorless, blue, bluish-white, brown, green or gray.

In 1799, Abraham Gottlieb Werner, sometimes called “the father of German geology”, named light-blue specimens of this mineral based on the Latin word *coelestis*, meaning “celestial”, or heaven-like. I’ve read that celestite weakly fluoresces yellow, white or blue under both long- and short-wave ultraviolet light, but my specimens must be duds because none did so under my UV lamp.

Celestite is usually found in sedimentary rocks such as limestone and dolomite, where crystals grow and fill in fissures and cavities, creating geodes. It also may be found within cracks in other rocks, such as hydrothermal veins. It’s often associated with gypsum and halite.

Nice specimens of celestite come from Ohio and Michigan in the United States, the Tsumeb region of Namibia, and Russia. At gem shows, you’ll see especially big blue crystal geodes from Madagascar. Although these crystals are pretty, their softness (Mohs 3-3.5) makes them undesirable for faceting as gemstones, but they do have other uses. Strontium sulfate is processed into other strontium compounds for industrial uses like metal alloys and for use in fireworks.

—Jim Brace-Thompson



Special Effects:

Iris or Rainbow Agate

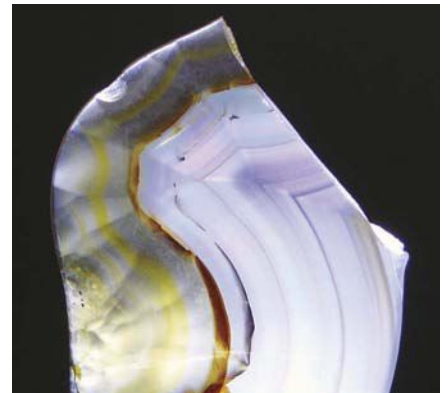
A rainbow is an arc of concentric bands exhibiting all colors of the spectrum. It forms opposite the sun when rays of light are refracted and reflected by falling raindrops. You also see it in mist sprayed by crashing waves along a seashore or even from an ordinary garden hose.

Some agates produce an effect very much like a rainbow captured in stone. This effect goes by several names: iris, rainbow or iridescence.

Some special banded agates may look like plain agates under normal reflected light. But slice them thin (1 mm to 3 mm), give them a high polish, and apply strong backlighting to transmit light through the stone, and a “diffraction grating” produces an astounding effect as light passes through very fine bands within the agate. You’ll see colors of the rainbow, iridescent colors that change and shift as the angle of view or backlighting shifts. The thinner the slice, the brighter the colors. Minute layers or bands create this diffraction grating, resulting in a rainbow effect from transmitted light. So thin are such bands that there may be more than 15,000 per inch, although 400 bands per inch will still produce the effect.

It takes an experienced lapidary artist to cut at just the right angle and thickness to diffract light in a way that brings out the rainbow, which makes such agate slabs rare and valuable. Agates exhibiting this effect are referred to as iris or rainbow agate. Some of the agates that produce this effect most reliably are found along the Yellowstone River in eastern Montana and in Rio Grande do Sul, Brazil.

—Jim Brace-Thompson



A thin slice of Montana agate under normal reflected light (left) and with light transmitted through the stone from behind and at an angle (right).

Spotlight on Juniors:

Liliya Starts a Rock Club!

As a fourth grader at Fred W. Hill School in Brockport, New York, Liliya Grego always had rocks with her. One day in 2012, Archer Noble, head of the Gifted and Talented program, asked what she had and she joyfully shared that day's specimens. She said she had started her own rock club in third grade. They met over lunch to talk about rocks. She said she knew of "a lot" of students interested in rocks.

Archer mentioned that, given sufficient interest, maybe a formal club could be started. Liliya was asked to provide a list of students. She submitted her list the very next day! She was then persistent in asking when activities could start.

Fortunately, one Community Volunteer at the school was associated with a local mineral society. Karen Rakoski and her husband, Frank, heard about Liliya's interest and agreed to mentor the group. Thus started a match made in heaven.

In spring 2013, Liliya's inspired rock club became the Ro-Ro Juniors Group of the Rochester Lapidary Society. The society voted unanimously to sponsor the group, which enrolled in the American Federation of Mineralogical Societies' Future Rockhounds of America Badge Program.



Liliya Grego was named 2015 Junior Rockhound of the Year by the Rochester Lapidary Society.

The Ro-Ro's have become an ever-growing, passion-fueled group that has rocks in their pockets and on their minds. Students who attend Liliya's informal lunchtime gathering have shown enthusiasm for all things rocky by crafting displays, giving presentations, and sharing what they make and learn with other students. They've



Liliya and the Ro-Ro Juniors Group installed a school display about rocks and minerals.

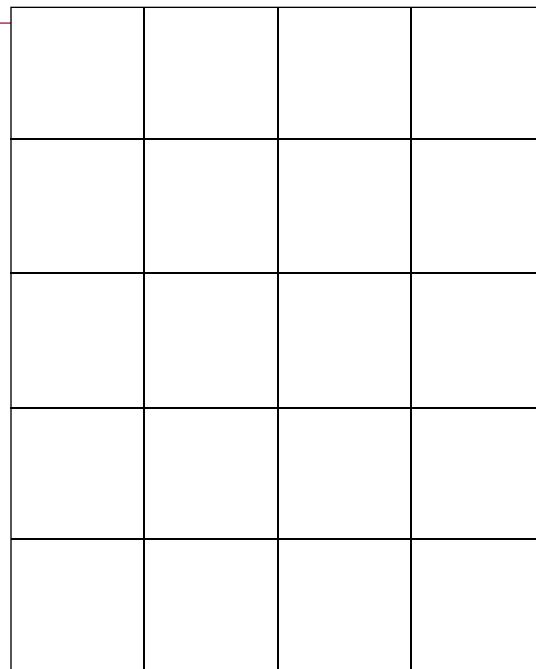
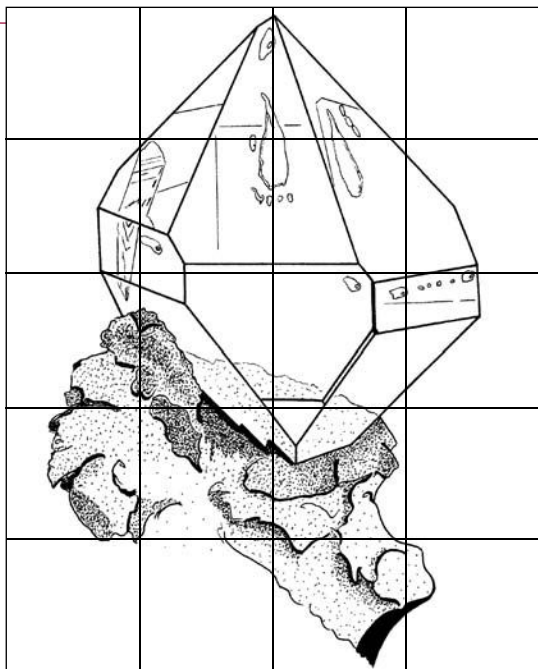
even met experts such as renowned mineralogist Bill Pinch.

Liliya was awarded the AFMS/FRA Rockhound Badge in November 2014, having earned six of the 20 activity badges offered by the program. In April 2015, the Rochester Lapidary Society honored Liliya as the 2015 Junior Rockhound of the Year via a recognition program run by the Eastern and American Federations of Mineralogical Societies. It all goes to show where vision, enthusiasm—and persistence—can take you!

—Jim Brace-Thompson and Karen Rakoski,
Rochester Lapidary Society

Mineral Sketchbook

A rockhound's field notebook is an invaluable tool on a field trip. When you encounter an unknown mineral, sketch it in your notebook so you can try to identify it when you get home. Test your drawing skills by recreating this quartz crystal using the grid as a reference.



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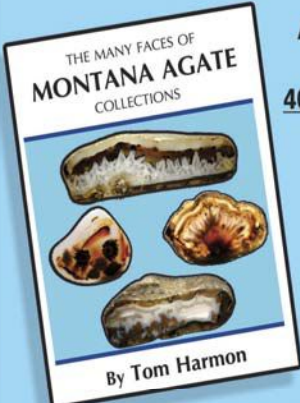
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This book is the author's third book on Montana Agate. The first was 'The River Runs North: A Story of Montana Agate' in 2000. He also co-authored 'The How-To's of Cabbing and Carving: Montana Agate and Other Chalcedony's' with son Jim Harmon, in 2005.

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BY CHRISTINE DHEIN

A Gold Mine in Your Studio

LUANA COONEN PHOTO



Use a folded piece of paper in the bench pan to collect bench scrap. Use a different piece of paper for each alloy.

LUANA COONEN PHOTO



Shallow cardboard boxes are an alternative way to collect bench scrap and is its own form of recycling.

Tips for Collecting Precious Metal Scrap

Precious metals and gemstones must be mined from the earth. At least 50% of newly mined gold is used in jewelry. Therefore, as jewelers, we depend on mining to obtain new materials. Mining methods—from large-scale mining that processes immense volumes of earth with huge equipment to small-scale mining where individual miners dig treasures from the earth by hand—and their impacts vary greatly. In each case, there are challenges to overcome, as well as opportunities to help people.

Challenges related to social issues include the impacts on local communities, human rights, child labor, and health and safety for miners. Environmental issues include the use of toxic chemicals, loss of agriculture or wildlife, deforestation, and soil erosion.

Mining can also provide valuable opportunities when managed properly, such as honest work for a great number of people, benefits for the country of origin, and delivery of quality materials to the jewelry industry.

As jewelers, we must be aware that challenges related to the social and environmental impacts of mining do exist. I do not mention them to make you feel guilty about buying precious metals and

gemstones, nor to stop you from making jewelry. On the contrary, this information is included to help you make the best possible choices regarding your materials.

As a jeweler, you have the power to make a difference by capturing as much precious metal scrap as possible and keeping it in the system, which benefits both the planet and your bottom line. Here are some simple steps you can take to reclaim the maximum amount of scrap in your studio.

COLLECTING BENCH SCRAP

Review your jewelry designs, planning and operations to reduce metal loss during fabrication, casting and cleanup. Be sure you have implemented every possible practice

for capturing precious metals from the time they enter to the time they leave the workshop. Precious metal particles can be found almost anywhere dust particles are found.

When working at the bench, use a system that helps you separate your metals for refining and helps you keep out the materials that should not be refined. For jewelers who work with various precious metals, a simple way to collect your bench scrap while keeping your karats and alloys separate is to line your bench pan with a large piece of paper, folded like a book with a crease down the center. Before switching to a different metal, sweep the metal dust and scraps from the paper into the collection container for the appropriate karat or alloy.

To save time, keep a clearly marked piece of paper for each alloy near your bench. Before beginning to work with a different alloy, lay the paper marked for that alloy in your bench pan. Careful use of this method will help increase purity in your scrap collection. If you diligently keep your alloy scraps separate, Alan Revere, founder and director of the Revere Academy of Jewelry Arts, suggests that scraps large enough to be picked up with a tweezers can be recycled in-house by casting them into an ingot.

An alternative to the paper pan liner is to use a shallow cardboard box for each alloy or karat being collected. You can use either collection system to prevent metals and other materials that should not be refined from entering your scrap.

Use an alternative piece of paper or cardboard to collect nonprecious metals, stone, plastics, and other materials that would contaminate your scrap. Benjamin Manning, of Utopian Creations in Adelaide, Australia, uses hard, flat, recycled wooden trays that slide in and out on runners for catching bench scrap.

Before sending scrap in for refining, use a strong magnet to remove all iron and steel [and remove steel parts from watches or other mechanisms]; Manning suggests using an old speaker magnet to remove steel. During refining, it takes more energy to separate out the iron from the precious metal, creating a greater impact on the environment and lowering your returns.

Linda Weiss, of Linda Weiss Designs in Santa Rosa, California, recovers precious metal dust from her broken saw blades, as well. She puts the broken blades (collected over the course of about a year) in a jar with water, which she places in the ultrasonic to vibrate off the precious metals. Then, she evaporates the water on top of her kiln. She states, "since this usually is a random mix of metal, I weigh and pack it separately from the known quantities".

Though she does this because she doesn't like to waste, she states, "even if I recover 2 to 3 dwt, at current metal prices, I think the time spent is also cost effective."

COLLECTING SCRAP IN THE STUDIO

As Marc Choyt, of Reflective Images in Santa Fe, New Mexico, states, "It's not just [at] the bench. It is every speck of dusk in our work area." Choyt says, "I accumulate all of this over a few years and send it in to our refiner ... and they send me a big fat check."

Manning and Weiss both use Quatro Air Technologies extraction systems at each bench tray to capture polishing dust. Manning used parts from a plumbing store to modify the debris capture area for the Quatro. James Binnion, of James Binnion Metal Arts in Bellingham, Washington, recommends a fully enclosed Quatro Pro polishing hood for capturing the maximum amount of precious metal dust at the polishing machine.

Manning uses natural rubber to cover the studio floor to capture materials that

Capture Precious Metals in the Studio

- Separate metal scrap
- Use a bench tray, apron, folded paper, or shallow cardboard box to collect filings and small scraps
- Before washing, wipe hands on reusable cloth or paper towel to collect fine particles
- Install a sink trap
- Use floor mats or carpet near doors to trap precious metal dust before it leaves the studio
- Use a fully enclosed hood to capture polishing dust
- Sweep or vacuum regularly with a dedicated vacuum
- Collect these items for refining:
 - Floor sweeps
 - Rags, paper/cloth towels, gloves, dust masks, aprons and work clothes
 - Buffs, brushes and emery paper
 - Sludge from sink trap, ultrasonic cleaner, tumbler and water vacuums
 - Polishing dust and vacuum bags/filters, respirator cartridges
 - Carpets and flooring
 - Plastic bags and tape that have contained or touched precious metal dust
 - Anything that has touched precious metals during jewelry manufacture



This Quatro extraction system has been modified to capture dust at the bench, and a recycled speaker magnet removes steel from bench scrap (inset).

fall to the floor and make it easier to see and recover everything. For workshops with carpeting, refiners suggest investing in a vacuum with a water filter. Not only will it help eliminate dust, the fast agitation of the machine helps to separate polishing compound from precious metal particles, and the water filtration system allows the heavier particles to settle to the bottom.

Reclaim precious metal particles from the sludge that collects in water vacuums, sink traps, tumblers, and ultrasonic cleaners. Especially for vacuum sludge, let the heavier materials settle to the bottom of the receptacle and remove the lightest material from the top. Then, allow the liquid from the sludge to evaporate.

Many refiners will calculate your total returns based on the incoming weight of your package. Therefore, it is in your best interest to allow sludge that contains precious metal particles to evaporate before sending it in for refining. You can promote rapid drying by passing sludge through a coffee filter.

CHOOSING A REFINER

It is important to do your research before selecting a refiner. Refining is not an industry that is FDIC insured. For the security of your business, select a company that has a track record you can trust. For the health of both the planet and our industry, verify that your refiner has earned third-party certification of the safety, environmental responsibility, and transparency of their operations. There are two most common types of certification for refiners.

SCS Global Services offers a Responsible Source for Precious Metals certification that verifies precious metals are derived from recycled sources and are conflict-free. Standards also ensure labor protections, improved sourcing strategies, and environmental practices, as well as requirements for continuing to improve environmental performance over time. For a current list of SCS Responsible Source refiners, visit www.scsglobalservices.com/certified-green-products-guide and perform a product search for fine silver or fine gold.

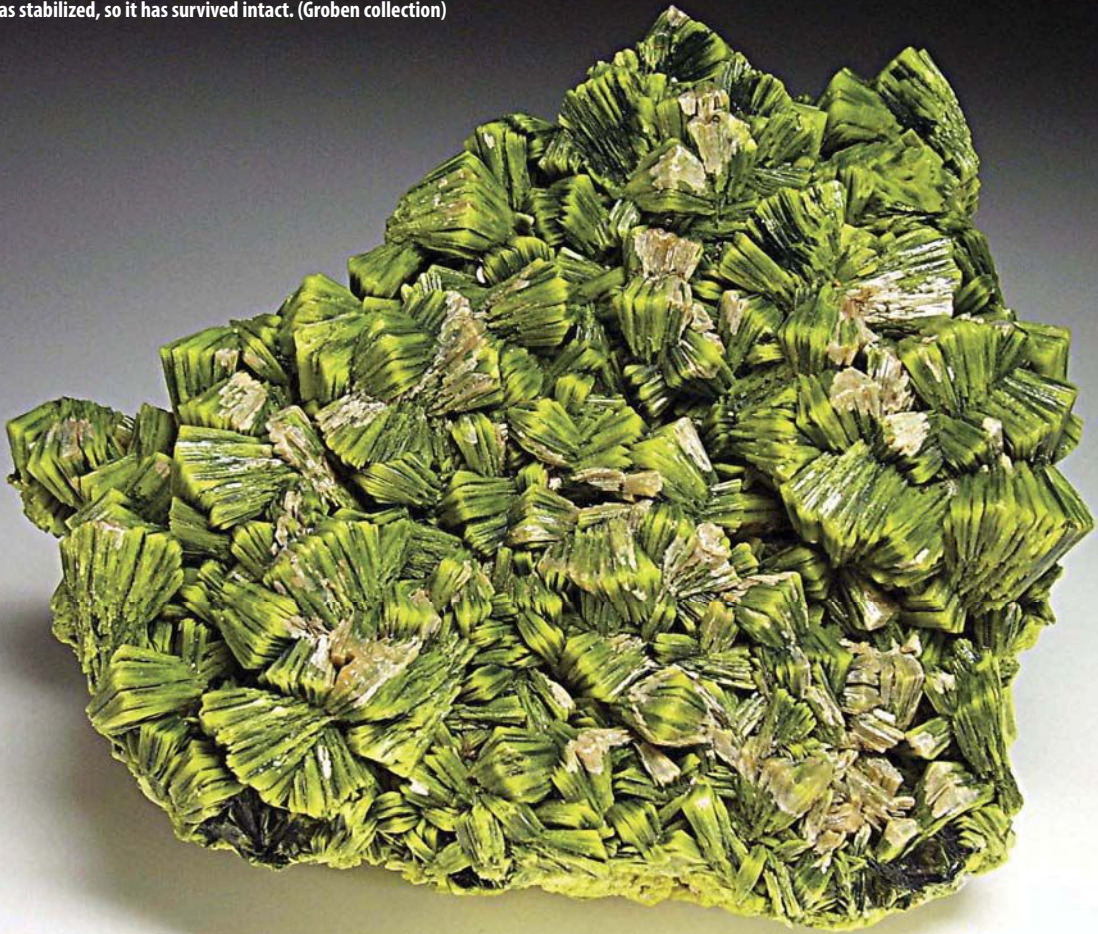
The Responsible Jewellery Council (RJC) certification programs are designed to support responsible business practices in the jewelry supply chain. Currently, two certifications are available. RJC's Code of Practices for RJC Member Certification addresses business ethics, human rights, and social and environmental performance. RJC Chain-of-Custody Certification is a voluntary standard, designed to build on the Code of Practices and focus on the flow of precious metals through the supply chain. For a list of current RJC certified refiners, visit www.responsible-jewellery.com/members/?cat=diamond-gold-and-or-platinum-group-metals-producer.

If you want to go a step farther to verify the transparency of a refiner's operations, and you are close enough to travel to their facility, ask if you can come in for a tour. ♦

Christine Dhein is an educator, author and jeweler with a Bachelor of Arts degree in Jewelry and Metalsmithing, and Assistant Director of the Revere Academy of Jewelry Arts in San Francisco.

The YIN and YANG of **RADIO** **ACTIVE** **MINERALS**

This specimen of strontian meta-autunite, composed of cockscomb crystal groups, was stabilized, so it has survived intact. (Groben collection)



BOB JONES PHOTO

Collectible Species Combine Beauty & Danger

Story by Bob Jones

Tell someone an object is radioactive, and they shy away from it. But tell that same person they have a form of cancer that can be cured with a radioactive “bullet”, and they are all for it! That’s the irony of radioactive materials: Used one way they kill; used another way they save a life.



The Cardiff mine, at Wilberforce, Ontario, produced this fine black uraninite cube, along with a crude apatite crystal. (Groben collection)



The radioactive element uranium accounts for more than half of torbernite's weight. (Margabal uranium mine, France)

A lesser-known effect is that they can cause a colorless mineral to glow beautifully under an ultraviolet (UV) lamp. Take, for example, common white aragonite or chalcedony. Introduce trace amounts of uranyl ion, and they'll glow a magnificent green under a UV light. Such radioactivity is virtually harmless because of the small amount.

We have certainly gained a great amount of knowledge and respect for radioactivity in the last 100 years. Before people understood the dangers of over-exposure to radioactivity, however, they unwittingly suffered its horrible effects. The luminous glow of radium-based paints led some people to think of it as a harmless novelty and convinced others to accept the widely touted notion that it had magical healing properties. Riding this marketing tsunami, manufacturers churned out personal care products like toothpaste, suppositories and cosmetics, and even foods like chocolate, butter and bread, containing the radioactive element. Spa patrons soaked in radium mud and drank radium water for their supposed health benefits.

People liked the watches whose numbers and hands glowed, allowing them to read it in the dark. Little did they know that the glow was caused by radioactive paint and that the people who applied the paint suffered horribly from exposure to it. To get the fine point needed to apply the paint to such small objects as numbers and watch hands, workers would lick the hairs of their paintbrushes, unaware that they were painting their tongues with radioactivity. The results were fatal, or at the very least required surgery to remove all or part of the affected tongue.

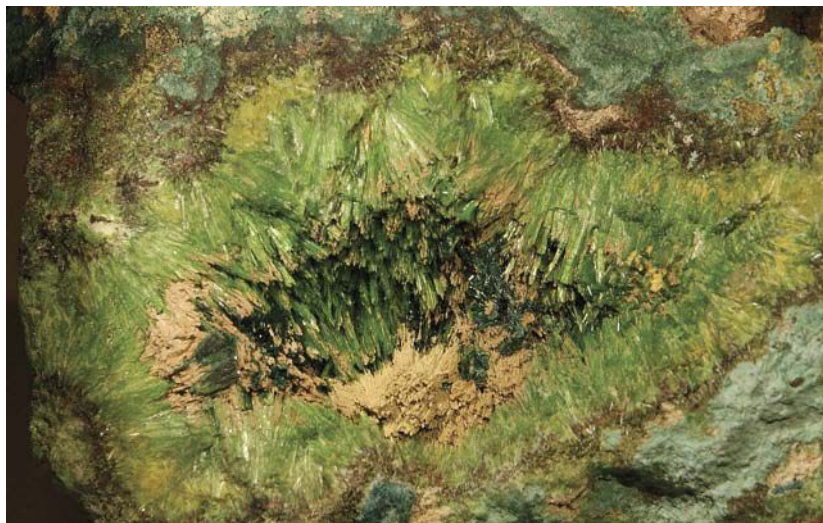
Marie Skłodowska Curie herself, who pioneered the study of radioactivity, was not immune. She was awarded the Nobel prize for her work on radioactive elements, but she eventually died from cancer resulting from long years of exposure.

The number of radioactive specimens in any given collection is usually low, and any harm resulting from a few specimens is minimal. The natural environment has some radioactivity in it, and people manage to live to old age. In 1946, at age 18, I was aboard a military airplane only 20 miles away from an atomic blast and I'm still here!

In the mineral-collecting world, radioactive minerals are quite often shunned by dealers and collectors both. With airport security as tight as it can be, anyone who has a radioactive mineral in their luggage can experience quite a challenge from TSA! There are plenty of beautiful minerals available without putting something radioactive on your glass shelf or in your carry-on bag. Yet we do collect these colorful beauties.



DIDIER DESCOUENS VIA WIKIMEDIA COMMONS



Clusters of green, radiating cuprosklodowskite needles virtually filled open vugs in the Musonoi mine (Democratic Republic of the Congo).

PUBLIC DOMAIN



Uraninite can alter into gummite, an amorphous mix of uranium minerals. (Zálesí uranium mine, Czech Republic)

I was in college right after World War II, and I recall my geology professor, Dr. Brown, telling the class about when he was doing fieldwork in the Four Corners area of the Southwest before the war. He was complaining about a powdery yellow mineral that was all over the place, masked rocks, and was a useless annoyance. He treated it with some contempt. He disdained for the "yellow stuff" was too bad because he could have retired rich if he had staked some claims. That yellow "stuff" was radioactive carnotite or tyuyamunite, which proved very valuable to the war effort.

Today, we don't even collect these two minerals deliberately, but the lovely yellows we see in some of Arizona's amazingly colorful petrified wood are caused by carnotite.

When stunning, green-bladed autunite was found in magnificent groupings at the Daybreak mine, at Mount Spokane, Washington, collectors lusted after these gorgeous clusters of cockscomb crystals. I don't recall anyone complaining about their strong radioactivity, but it was definitely there!

Studies showed that the individual blades of autunite were actually complex strontian meta-autunite, a strongly radioactive substance. The micaceous blades hosted strontium atoms in their structure, but because they had lost water, they had altered to meta-autunite. Even more interesting, the blades showed myriad black spots, concentrated near the base of each blade. These proved to be uraninite (uranium oxide), the "hottest" of the radioactive minerals from which many secondary radioactive minerals are derived. Still, folks eagerly collected the mineral.

The only problem with the Mount Spokane meta-autunite was that, if you washed it, you could literally watch your specimen fall apart in your hands, as there was virtually no bonding between the micaceous

blades. For that reason alone, you don't see very many Mount Spokane meta-autunite specimens around these days. One thing I used to do is coat the specimens with clear liquid plastic to seal them so they survived. Any specimens you see today are definitely sealed.

It is not necessary to seal the gorgeous needles of cuprosklodowskite found in the Musonoi mine, near Kolwesi, in the Democratic Republic of the Congo. Large clusters of the shimmering green, radiating needles virtually filled open vugs. The gorgeous copper, uranyl, hydrous silicates hit the market in the 1980s and were swiftly gobbled up by collectors. Named to honor Maria Skłodowska Curie, samples of this beautiful radioactive mineral are still seen in collections and on display at major shows. Are they dangerous? As long as you don't sleep with your specimen under your pillow, you have little worry about.

ROB LAVINSKY PHOTO



These sharp, euhedral betafite crystals are slightly radioactive and host several reddish zircon crystals (Silver Crater mine, Bancroft District, Ontario).

Keep in mind that radioactive minerals give off radon gas, which can be harmful, but radon gas is very heavy and it tends to settle in a mineral drawer or sink to the floor and dissipate. When federal inspectors visited the Klein Geology Building at Yale to test the mineral room for radioactivity, specifically radon gas, they got extremely low readings even though there were radioactive minerals on shelves and in drawers. Then they opened the drawers containing radioactive minerals and checked inside. The radon gas that had accumulated in the drawers flowed out and down to the floor, where radon readings were suddenly considerable. The moral of that story is that, if you have a number of radioactive minerals in a drawer, be sure the drawer is somewhere other than in your house.

Nevertheless, if you choose to collect a quantity of the 90 radioactive minerals, you should make special arrangements for their storage. Handle them infrequently and wash your hands after you do. If you can obtain sheet lead, make a box in which to store them. Otherwise, store them in your garage or in some outbuilding, and be sure kids can't get at them. If you have only one or two radioactive minerals in your collection, you can display them, but be sure your mineral room is well ventilated.

When my sons, Bill and Evan, and I joined Patrick Haynes to collect bobjonsite at the North Mesa #5 mine in Utah, we had all the necessary protective equipment; since the mineral occurred in a closed uranium mine, the space was probably loaded with radon gas. Every rock we picked up on the mining site made the scintilometer needle jump. The mine had already been partially sealed by the state, since there are recreational areas nearby and an open mine is a tempting site to explore. People who didn't realize the inherent danger in the radioactivity and radon gas in the mine's interior could walk into the open



▲ Radioactive uranophane forms from the oxidation of uranium-bearing minerals. (BYU Department of Geology)

► Solid, bright green-yellow autunite crystals in the form of thick wheat-sheaves are representative of the best specimens from the Daybreak mine in Washington.



ROB LAVINSKY PHOTO

tunnel out of curiosity and suffer ill effects.

The main tunnel into the mine had been sealed with concrete, but one of the rear tunnels had not. We followed Pat into the mine and he led us to the tunnel area where he had found what were then-unknown minerals. We had no way to test for radon gas inside the mine, which had been abandoned for decades, so we wore a breathing apparatus Bill used in his assay lab to guard against all sorts of fumes and dust. Respecting the dangers of radioactivity simply makes sense. In fact, when we finished digging bob Jonesite and got back to the motel, we changed clothes and showered, putting the digging clothes into the car trunk until we got home.

The beauty of most secondary radioactive minerals is the intense color many of them have. Uraninite, betafite, and other uranium-rich primary minerals lack color, but are nicely crystallized and collectible. These crystals are really "hot", as they say. Most of the radioactive minerals we collect are derived from these primary species. The beauty of these secondary minerals is in their bright yellow to green color.

Of all the colorful radioactive minerals, a select few are found abundantly and in very attractive crystal specimens. Most spectacular is the earlier-mentioned autunite, which was once mined in quantity at the Daybreak mine. The actual name of this mineral is stronitan meta-autunite, which indicates considerable water loss and the presence of strontium in the chemistry. Most specimens from the Daybreak consist of platy blades clustered in cockscomb form. Specimens sometimes reach as much as a foot across, with individual blades as much as 2 inches across.

The natural color of this autunite is a lovely green, with some yellow hues in thin crystals. Under a UV lamp, the green intensifies brilliantly. The edges of crystals are a dark lime green, with the green color tending to lighten toward the base of each crystal. Almost all crystals show some of the included uraninite, described earlier. This suggests to me that Mount Spokane autunite is probably the most radioactive example of a colorful uranium mineral. Because so many specimens were not sealed until it was too late to prevent water loss,

these beauties are rare birds these days.

Autunite is probably the most common of the colorful radioactive minerals. It fluoresces a brilliant green and is found in a wide range of pegmatite deposits as small green flakes on rock. The type locality is Autun, Saône-et-Loire, France. Crystals from here are typically small, platy, green flakes scattered on matrix.

A mineral that can easily be mistaken for autunite is torbernite, which can also be found in pegmatite deposits. Torbernite tends not to fluoresce; like autunite, however, it loses moisture very easily. Most of the torbernite found is actually meta-torbernite. The classic example of this bright-green mineral was found in the Old Gunnislake mine, near Callington (Cornwall), England, in the 1700s. The finest example of these classics is in the Williams collection at Caerhays Castle in Cornwall. The Williams family owned the mine when the torbernite was discovered, and the fine specimens in the Natural History Museum, London, were originally in the Williams collection.

In recent years, the copper-uranium deposits around Musonoi, DRC, produced remarkable specimens of cuprosklodowskite, cubes of uraninite up to an inch on an edge, and fine specimens of other radioactive minerals. The Musonoi cuprosklodowskite was found in clusters of bright needles, tightly bunched on matrix. The needles are an intense, deep green, sometimes ranging to a lighter green near the tips.

Certainly, the strangest uranium deposits to be mined are Oklo, in Gabon, Africa. A variety of vanadium and uranium minerals—some of which occur nowhere else—were found here, including chervetite and francevillite. What makes these deposits unique is that they are the site of naturally occurring nuclear chain reactions.

The concentration of the uranium 235 isotope is so high that, anytime the water level drops and the U-235 is exposed, atomic fission reactions are triggered. In effect, the deposit is a natural nuclear reactor. When the water table is high, the swarm of neutrons given off by the U-235 is absorbed and the atomic reactions cease. Oklo is the only known site at which nuclear fission reactions naturally occur. I think this makes the specimens it produces unique and worth owning.

You must take reasonable precautions if you're going to store many radioactive minerals in your home. Having one or two in your collection is probably OK, as long as they are not handled much and are kept well out of the reach of children. After handling radioactive minerals, you must wash your hands thoroughly. If you wish to build a significant collection of radioactive minerals, they are best kept in a well-ventilated facility that is not frequented by the family, such as a garage. Common sense is the watchword. 💎

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WHAT TO CUT

by SCOTT EMPEY

Polka Dot Agate

Several years ago, some like-minded friends and I made a great trip up to Oregon for the annual Prineville and Madras shows. It was pretty much 10 days of rocks, rocks, and more rocks, a trip I highly recommend. After spending a day at Richardson's Rock Ranch digging thunder eggs, we decided to head over to the Polka Dot agate mine nearby—"just look for the polka dot trailer", they told us at Richardson's. Sure enough, after following the directions, we came upon the white trailer covered in multicolor polka dots, looking like a big loaf of Wonder Bread®.

The Polka Dot beds are a fee-dig site owned by West Coast Mining that is usually open in the summer, from Memorial Day to Labor Day. You can dig your own material or purchase pre-dug agates by the pound. At the mine, we met Dale Hewitt, the owner of West Coast Gems and proprietor of the Polka Dot agate mine. The mine is on a hill above a picturesque canyon—a really beautiful location for one of the more unusual and interesting agates from the area.

On the hillside near the deposit were a multitude of 50-gallon drums, each filled to the top with cutting material from several different locations mined by Dale, like a big open-air rock shop.

The Polka Dot agate deposit has been producing fine agate for a long time and is still going strong. There are also a couple small caves adjacent to the deposit itself. For centuries, Native Americans mined the deposit, using the hard agate and jasper for tool making. Artifacts made from this distinctive agate have been found as far away as Colorado. While many locations have a former heyday—some time in the past when the "good stuff" was coming out—this does not seem to be the case at the Polka Dot mine. The good stuff just seems to keep coming.

Polka Dot agate is an orbicular variety. The agate is dotted with variously colored orbs, floating in a base of agate or jasper that ranges from white to blue in color. Translucency varies from piece to piece and the dots can be black, brown, red and yellow, although an orange-brown seems to predominate in the orb department. The dots are sometimes hard edged, while some are kind of fuzzy-edged, like little floating snowballs.



There is all kinds of crazy stuff going on in this agate. When the agate gets to be a translucent sky blue, it is known as "blue ice". Some of the agate has opaque, reddish-brown jasper running through the translucent sections. I consider the blue ice with dots and jasper bands to be the best for cabbing.

Cutting this material is pretty straightforward; it is a nice solid agate that takes a great polish. There's nothing really tricky to watch out for in terms of cutting the cabs. I think the difference between a good stone and a great one in this material usually comes down to one thing: composition. There is a lot to work with in this agate; there are orbs, bands, waves, and occasionally a black dendrite or two. I spend more time just thinking about what I'm going to do with this material than with most others.

Polka Dot agate has lots of variety in the patterns, and all the interesting details are often found right alongside each other. I try to use the jasper sections or bands as dividing lines in my designs, bordering the top, bottom or one of the sides with jasper or using thinner bands to split the design into two sections, not necessarily symmetrically but more of a one-third/two-thirds kind of arrangement, with the dots all mixed in around. Sometimes, you can get a nice scenic landscape design, even if the landscape looks like it's from another planet. ♦

Scott Empey, owner of Gerard Scott Designs, creates hand-cut gemstones, designer jewelry, and props for the motion picture industry. His Web site is www.gerardscottdesigns.com.





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Black Hills Pegmatites



The diverse pegmatite mineralogy observed at the Tip Top mine is sure to spark some curious conversations among visitors.

Two Choice Mines with Mineral Cornucopias

Story and Photos by Mark Leatherman

I have got to go back," I thought when I was a graduate student planning a two-week field trip out West. I was president of a Society of Economic Geologists (SEG) student chapter that was planning a trip leg across South Dakota. After taking a vote, in which our group chose to visit some pegmatites, I automatically knew of one that is a must-visit: the Tin Mountain mine.



Chalky white euhedral spodumene crystals are found in a variety of sizes, and there are plenty for everyone. (The crystal on the left is nearly a foot long.)



Pegmatites such as those of the Tip Top mine provide a golden opportunity for geology students to experience mineralogy on a grander scale.



Pink- to red-hued Black Hills rose quartz is readily found at the Tip Top mine. The white streaks are thought to result from fluid inclusions.

My first introduction to the Tin Mountain mine was in July 2008 as part of my undergraduate field camp. The gaping “hole in the wall” that greets visitors was unforgettable for me, and I made a point to return here with a group in the future. Five years later, that plan came to fruition.

In wanting to maximize our pegmatite experience—especially for those who had never seen them up close—I knew that just the Tin Mountain wasn’t enough. Of course, there are literally hundreds of pegmatites in the Black Hills, so choosing only one more was quite a steep task! To help make the choosing much less painstaking, I first contacted Thomas Loomis, of Dakota Matrix Minerals, and he was an invaluable help. After mentioning that Tin Mountain was a desirable spot, as well as a variety of minerals and chemistry to look at and discuss (respectively), he mentioned that he owns the claim to a place called the Tip Top mine.

Two mines very close by: Check. A wide variety of collectible minerals: Check. A great learning opportunity: Check. Ease of access and friendliness of setting up a visit: Check. We were set to go!

It was a late May morning in Keystone, South Dakota, where 12 of my fellow students and I stayed at the local Econo Lodge. Having seen the Badlands and Devil’s Tower the day before, we were pumped to tour a piece of the Black Hills’ beating heart. We loaded up around 8:30 a.m. and drove an hour to Custer. We headed west of town along U.S. Highway 16 for 15 minutes, then made a left onto Pleasant Valley Road. After making a right and a left at two Y-intersections, respectively, we reached the Tip Top site.

We stopped at a green gate and had to hike about a quarter-mile up a slight incline to the myriad tall dump piles. Along the way, we were treated to appetizers in the form of small crystals of quartz, muscovite and K-feldspar in the dirt trail. When we reached our destination, we stopped for the mandatory educational talk on pegmatite geology.

Pegmatites are both a rockhounding nirvana and an intriguing area of research. A pegmatite is broadly defined as a felsic (rich in silicon, sodium, potassium) intrusive rock that displays anomalously coarse crystal sizes (typically greater than 1 cm). Being granitic in nature, the common minerals are quartz, feldspar, tourmaline (schorl), mica and beryl.

The Black Hills are especially known for producing large “books” of muscovite mica. Classical geologic thought initially pegged these large crystals as the result of extremely slow cooling. However, more recent research has shown that, with evolving crystallization, pegmatitic melts become much richer in fluids and “incompatible” elements (i.e., lithium, cesium, tantalum, fluorine, phosphorus, boron, and a few others) that are too big or small to fit into the crystal structures of the earlier-formed minerals mentioned above. This is thought to have two consequences: 1) decreased nucleation rates (formation of crystal “seeds” from which growth takes place), and 2) increased diffusion rates (the transport of atomic “ingredients” across the crystallization system to build upon growing crystals); in other words, the growth of fewer, larger crystals.

Rock & Gem gives locality information for reference purposes only. Readers should never attempt to visit any of the sites described in this publication without first verifying that the location is open to collecting and obtaining the permission of the landowner and/or mineral rights holder.



Dark splotches found on this Tip Top specimen of K-spar (thought to be due to manganese oxide inclusions) makes this common mineral a special treat.



Pale-green, semi-gemmy spodumene can reward the persistent (or lucky) rockhound at the Tin Mountain mine.

Although these crystals are mostly a few centimeters in size, some bodies boast gigantic crystals measuring feet to meters long and even weighing in the tons! Due to their sheer size, they are mostly mined for industrial raw materials. There is still great debate going in academia regarding pegmatite origin, and numerous articles and books have been written. Interested readers are encouraged to look up the works of Petr Cerny, Peter Nabelek, David London, Thomas Loomis, William "Skip" Simmons, and Mona Sirbescu.

It actually took a U.S. Geological Survey (USGS) strategic mineral mapping team, led by E.W. Heinrich, to produce an initial classification scheme for pegmatites ("pegs") during World War II. The map was based on the presence of discrete mineralogical zones, which are divided into simple, zoned and complex types.

Simple pegs are uniform in composition and texture, are the most common, and mostly consist of quartz and feldspar with lesser mica and possible schorl. Zoned pegs can be mapped into zones of discrete mineralogy and display numerous textures. The zones are classified (from the country rock border inward) as border, wall, one to two intermediate zones, core margin, and core zones. The variation of mineralogy here is much more vast and exotic, and can include garnet, microcline, spodumene, lepidolite, columbite-tantalite, and multiple phosphate minerals such as apatite.

Complex pegs are zoned and have secondary cross-cutting units such as fracture-filling veins of fine clays and/or feldspar. It is these pegs that can display exceptionally fluid-rich clay pockets, which can yield vast riches of gem tourmaline and beryl crystals. Examples of this are prevalent in San Diego County, California, Oxford, Maine, and Mount Antero, Colorado.

The later, exhaustive work of Canadian geoscientist Petr Cerny has led to another widely accepted classification of pegmatites

into classes based on emplacement depth, degree of metamorphism, and concentrations of certain rare elements. The Black Hills pegmatites fall under a category known as "LCT", which means they are enriched in the rare elements Lithium, Cesium and Tantalum. (The other major rare-element class is "NYF", for Niobium, Yttrium and Fluorine). These pegmatites are also considered to have formed from low-pressure conditions (amphibolite to upper greenschist facies), with temperatures ranging from 500°C to 650°C.

The numerous pegmatites that dot the Black Hills landscape are products of magmatic activity associated with the Trans-Hudson Orogeny, which took place 1.8 billion to 2.0 billion years ago and started the construction of the North American continent. Geologically speaking, the Black Hills uplift displays a bull's-eye pattern, wherein the granites (and pegmatites) form the core, followed by schist country rocks, and then by progressively younger, sedimentary rocks dipping outward. Although Black Hills pegmatites are rather gem-barren, their industrial mineral wealth still entices many a collector!

The mining of Black Hills pegmatites has dated back to the 1880s, with the first activities taking place at the Crown (McMackin) pegmatite to extract mica. About 4 tons of mica were extracted during that time, with the next sought commodity being tin. For a decade, the Harney Peak Tin Co. mined cassiterite (SnO_2) there, until scandal and low production led to its decline.

The next wave of mining began at the turn of the 20th century, when the Black Hills pegmatites became the nation's leader in lithium, feldspar, beryllium and mica production. The Tip Top mine was initially worked for its beryllium content; however, it has become a prime site for phosphate mineralization, as well as associated micro-minerals such as montgomeryite, collinsite, kingsmontite and rockbridgeite.

Conversely, the Tin Mountain mine was part of the lithium powerhouse that has also produced good specimens of zircon and columbite-tantalite crystals. As with most mining powerhouses, the area has witnessed its ebbs and flows, with very little—if any—production going on in the present day.

THE TIP TOP MINE

After the introductory spiel, everyone scattered to their initial hunting spots. The immediate landscape was dominated by a very tall tailings pile, with a couple smaller ones to the immediate west and a flooded pit to the north. I started on the tall pile and immediately began to find large, euhedral, salmon-colored K-feldspar crystals. Most of these crystals are elongate and display some of the clearest "muscle-fiber" twinning I have seen during my rockhounding ventures. Feldspars are known to be among the silicate minerals most susceptible to weathering, but there was not a trace of that here! Every single crystal found here was glossy and pristine, and required absolutely no rinsing.

In continuing my hunt around the middle of the tailings pile, I started to find more tabular K-spar crystals, but few actually contained sporadic round, black spots (almost like a Dalmatian feldspar!). I found the nearest boulder and briefly sat down to ponder this feature. After not much time to think, an undergraduate student came up to me holding a similar piece and wanted to ask me about it. At first, I thought the spots were due to atomic-scale metal of some sort. Upon conversing with Thomas during a follow-up conversation, however, we decided the more likely explanations for these spots were the presence of manganese oxides (even though it does not display the familiar dendritic habit) or minor instances of cassiterite crystallization.

After our chat, I started to walk northeast toward a slope, passing by more



The majority of our group collected inside the portal of the old, but safe, Tin Mountain mine.

undergraduate-graduate student pairs talking in-depth mineralogy. About 20 yards away, an undergraduate called out to me that she had found some awesome-looking rose quartz. Of course, I immediately went over to investigate, partially because I felt a slight tinge of green eyes arising due to not finding any yet! The rose quartz was mostly in a small depression, and I started to pick up some small, palm-size, jagged crystals, which the sunlight easily shone through, giving the crystal a gellike appearance. As gemmy as those pieces are, my thirst would not be quenched without some bigger, lapidary-size pieces!

Making my way down the slope, I heard the sound of approaching trucks and was wondering if I would have to round the troops up sooner than I had thought. It turned out to be just a few Forest Service members coming up to do work in the nearby woods, so we were able to carry on.

In going back up the main slope facing north, I had my rose quartz thirst quenched! I collected some of these beauties, which displayed a cool feature the smaller pieces did not: internal, milky white lines, or stringers. In doing some later source checking, I found out these lines are actually trails of gas-rich inclusions. These are probably a relic of being trapped in an extremely fluid-gas-rich crystallization medium.

My next intriguing find also came in the middle of the tailings slope. I spied a hand-size dark mass with a distinctive fine grain and metallic sheen. It was black to bluish-grey in hue and was 100% anhedral. Upon doing a light scratch test, I smelled a very faint odor of sulfur. I then thought to myself that sulfur in pegmatites is quite rare, but certainly not impossible.

I had to wait two months after the trip until I could test the specimen with a portable X-ray diffractometer (XRF). The preliminary results showed the specimen did indeed contain considerable sulfur, along with iron, zinc, copper, minor silver, and quite possibly more! Upon consulting with

Thomas, neither of us came to a solid conclusion on a definite mineral name. Nonetheless, I was extremely satisfied with this rare find and still have it in my collection.

THE TIN MOUNTAIN MINE

After an hour of group searching, we hiked back down to our vans and departed towards the Tin Mountain pegmatite, just 10 minutes away. After continuing west-bound along U.S. Highway 16 for another 2.5 miles or so, we turned right onto F.D.R. Road 287. We stayed right at the first intersection and drove through some logging land for around a half mile. This time, there was no gate to impede driving, but there were a couple deep-looking, muddy pits that we did not want to risk.

After gearing up, we walked around the puddles. The hike to this site was much shorter. Even before stopping, the huge mine opening present in the tall rock wall definitely resulted in some jaw drops! We spread out right away, with some starting at the much smaller spoil piles, while a majority headed inside the old, but safe, mine.

Since I had been here before, a part of me wanted to see if I could outdo my previous collecting success. I walked away from my 2008 visit having found the biggest spodumene ($\text{LiAlSi}_3\text{O}_8$) crystal of anyone in the collecting group. Most campmates thought I was nuts for lugging that thing around whenever we had to re-arrange vans and tear down camp. One fellow camper commented that I was like a kid in a candy store!

I resisted the initial urge to enter the mine and searched a small path off to its right, and I was instantly rewarded with a smaller, but semi-gemmy, pale-green spodumene crystal. Within a couple more paces, I also stumbled upon a chalky white, euhedral crystal that I immediately dubbed my "coaster crystal" due to its very flat, elongate, rectangular habit. If one ever has a need to collect various-sized crystals that depict Steno's Law (of consistent crystal angles), this is a prime locale.

After collecting a few more representative spodumenes and starting a pile, I joined the majority of the group inside the mine portal. A few person-size holes are dug into the walls, and I investigated to see if there were any extractable crystals I may have missed from my first go-around or had become newly exposed between my visits. From what I gathered, there was nothing worth hammering, but the walls were covered with small, warped, greenish crystals of lepidolite. I then managed to find some off-white, prismatic orthoclase crystals on the interior spoil piles, along with some boulder-size, semi-gemmy anhedral quartz crystals.

After adding these to my pile, I explored the tall spoils slope immediately adjacent west of the opening, but didn't find much else that was new to me. In securing a healthy collection of various palm-size muscovite books and spodumene, orthoclase, and clear quartz crystals, I was not yet 100% satisfied because I had not found any large boulder-sized muscovite books, nor crystals of columbite-tantalite that I've heard were found here. After briefly conversing with some students on their experience and finds, it became apparent that I would not be getting my wish on my second go-around.

After another hour here, I started to round everyone up for another short lecture on how we are near the core of the pegmatite, given its visible zoned nature and mineralogy. Then we packed up our finds and walked back to our vans. I wished we had more time to stay in the Black Hills, as there are dozens of "pegs" that rockhounds can explore. However, as the purpose of our trip was to gain exposure to as wide a variety of mineral deposits as possible, we had to move on. I know for sure that this area will always beckon me to come back.

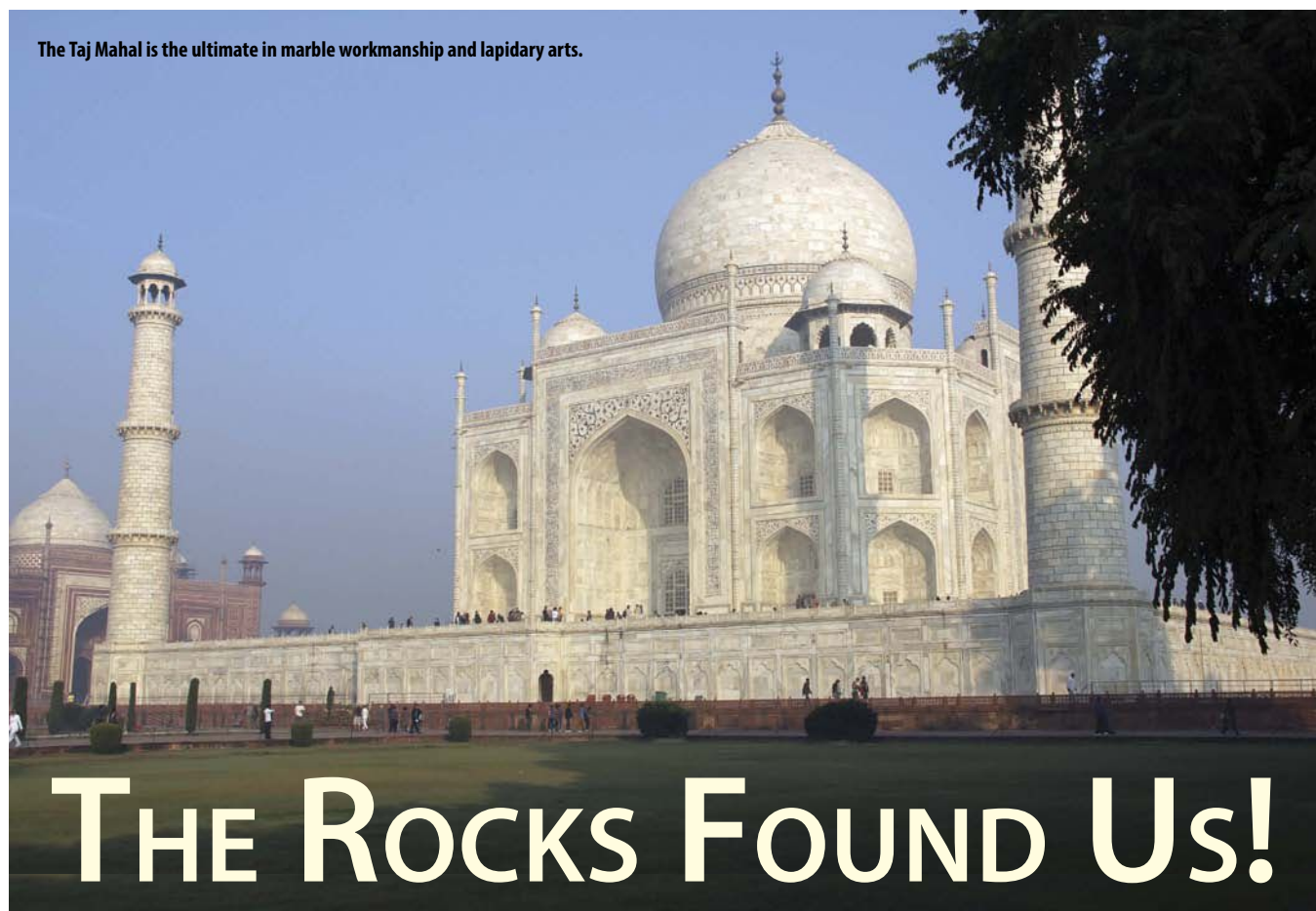
GETTING THERE

The GPS coordinates for the Tin Mountain site are 43°44'49"N, 103°43'14"W. On both my visits to the Tin Mountain site, driving in was never an issue. Nonetheless, property status can change without notice, and one should always research to see if permission is required at the current time.

The GPS coordinates for the Tip Top mine site are 43°42'56"N, 103°40'10"W. Permission must be obtained from Thomas before visiting the Tip Top site. He was not able to come out and join us on our visit, but getting the green light is always necessary. Thomas can be contacted at dakota-matrix@gmail.com or (605) 718-9130.

Both the Tip Top and Tin Mountain sites are quite excellent places to visit for those learning about pegs and mining history, want great collectible variety, relative ease of access and finding quality specimens, and just great rockhounding in general. Whether you are into micromounts or huge honkers, both of these sites definitely have something for you! 💎

The Taj Mahal is the ultimate in marble workmanship and lapidary arts.



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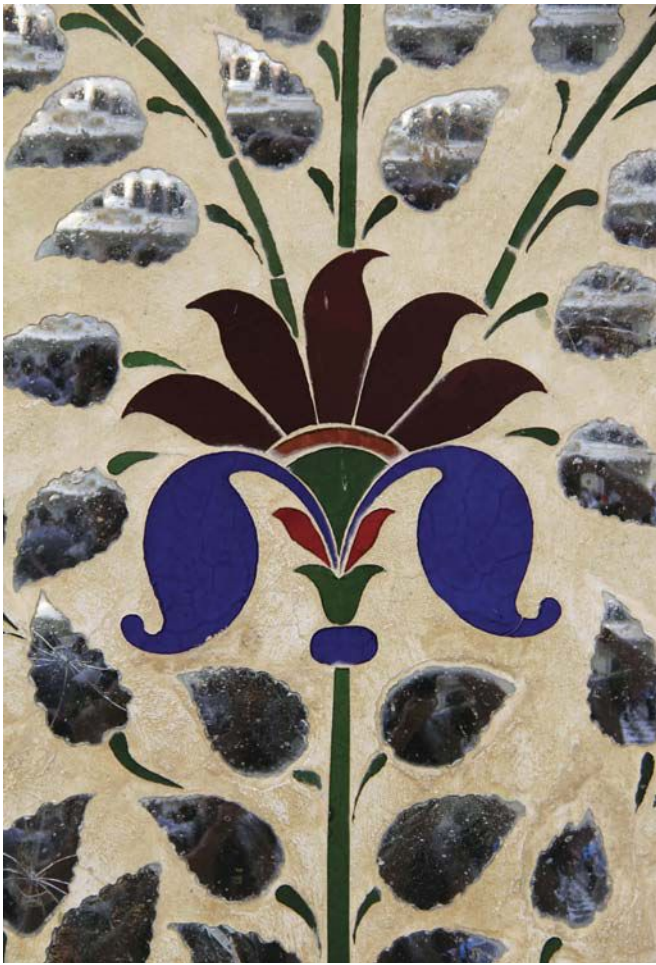
Exploring the Lapidary Arts of Northern India

Story and Photos by Jim Brace-Thompson

When my wife, Nancy, and I planned an adventure trip to India in fall of 2013, we knew we would be accompanied by our non-rockhound friends Mark and Lynne, so we agreed we would be soaking in the history and culture of this ancient and storied civilization, not looking for rocks. Plus, Nancy had one big priority: to take a ride to the Amber Fort atop one of her favorite animals, an elephant.



At a shop, we were treated to a demonstration of traditional methods for shaping and polishing stones using hand power.



Inlay made of lapidary stones adorns palaces throughout northern India.



Inlay at the Taj Mahal includes decorative floral motifs with semiprecious stones, as well as verses from the Koran in black marble.

I reluctantly gave in to peer pressure and agreed to forego anything connected to rocks especially since we would be in the northwest, rather than the southern region around Poona, which I knew to be famous for zeolite minerals, such as cavansite, apophyllite and stilbite from the volcanic Deccan traps. I wasn't expecting such rocky delights in the northwest.

What I never realized until we arrived and began visiting markets, forts and temples was just how vibrantly the lapidary arts have been woven into the fabric of Indian life and how lapidary would evolve into an unintended focus of our trip. While we weren't looking for gems and minerals, quite literally, the rocks found us!

India is divided into 29 states and seven territories, and most of our travels would be confined to the state of Rajasthan on the Pakistan border as well as Agra in Uttar Pradesh and the city-state of Delhi. We were in this general region, in part, because the company I work for has an office in New Delhi, where we arrived to find traffic jams of biblical proportions.

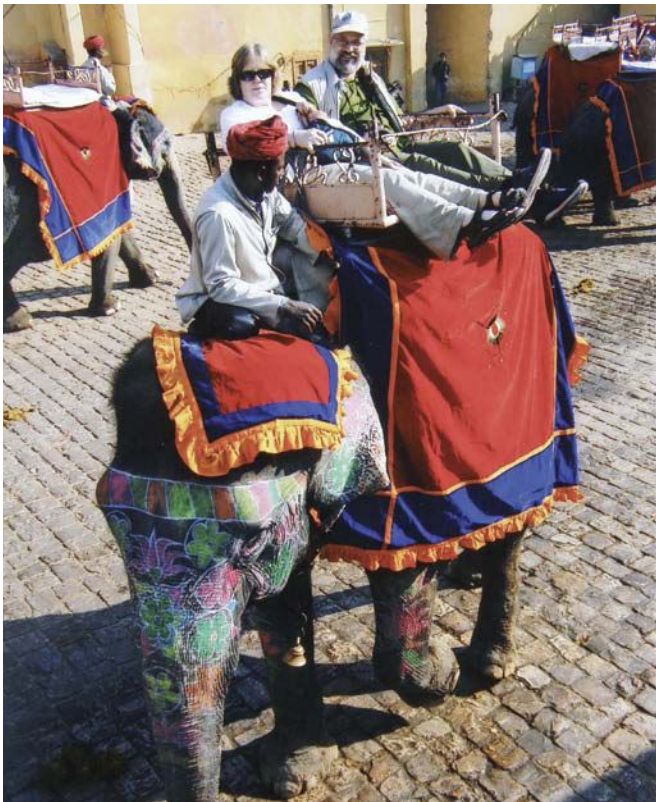
To drive in India, our van driver told us, you need three things: "Good horn. Good brakes. Good luck!" In addition to innumerable cars, tuk-tuks, motorcycles, and hand carts, all ignoring established lanes, you never know what you might encounter around the next bend: a camel-powered cart steered by the tail, a horse-drawn carriage, or even an elephant with a "driver" perched on top. Crossing streets as a pedestrian proved daunting, but our guide assured us, "Walk like a cow, and the traffic will part for you." Sure enough, he was right!

Following business meetings and niceties, we began our tours and soon discovered that India has a long tradition of princes and maharajahs serving as patrons of the arts. In addition to poetry, literature, music and painting, they supported such lapidary arts as silverwork, gemstone cutting, stone and marble carving, and inlay with precious and semiprecious gemstones. At every turn, we found examples of each.

Silver work, in particular, is revered. On display at forts and palaces, we saw gorgeous silver plates, cups and vessels. Silver-worked items have been given to mark such occasions as treaty signings and for wedding dowries. We were there at the height of the wedding season, wedged between late September and January. This is when weather in northern India is just about perfect, after the summer heat and before the monsoons. As we drove through villages and cities, we saw grooms paraded like peacocks on horses or camels, with silver dangling from the reins.

We also saw plenty of Nancy's favorite animal cast in silver, as well as the Hindu elephant god, Ganesha, the remover of obstacles, patron of arts and learning, deva of intellect and wisdom, and god of beginnings. Nancy has a collection of elephants carved in precious and semiprecious gemstones, so she welcomed every elephant image we encountered in stone and in silver.

In Jaipur, we viewed the ultimate silversmith's commission: a huge sterling silver vessel ordered up by Maharaja Saai Madho



Nancy, who collects carved gemstone elephants, finally got a close-up encounter with her favorite animal.



Every nook and cranny of the marble Jain temple at Ranakpur has been intricately carved and polished by hand.

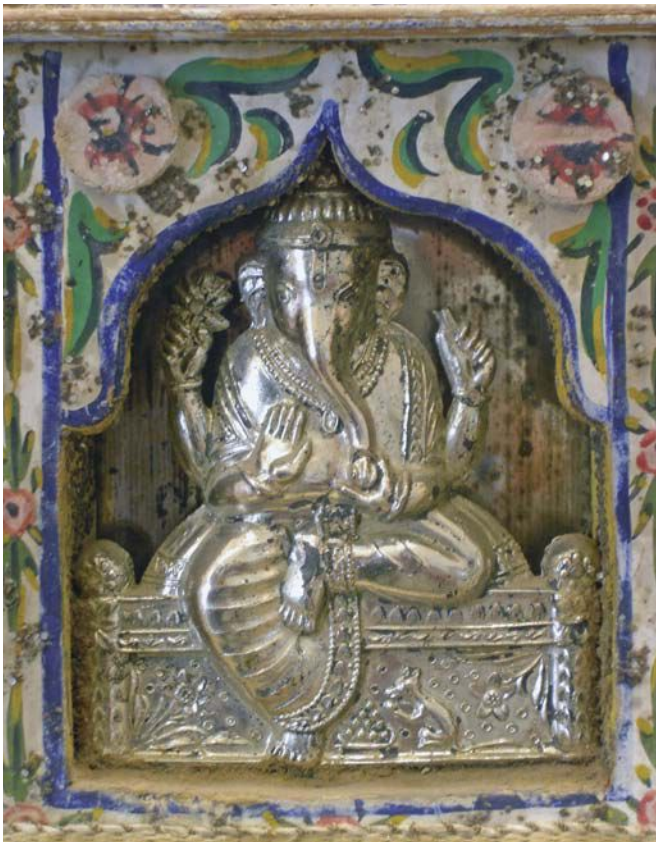
Singh II before heading to Great Britain in 1901 for the coronation of King Edward VII. According to our guide's story he had heard of the foul nature of the River Thames and so insisted on bringing his own, safer supply of drinking water from India. The vessel is over 5 feet tall and holds 4,000 liters (1,056 gallons). Made from 14,000 melted silver coins, it has the distinction of holding the Guinness World Record as the world's largest sterling silver vessel. And, if you think that's impressive, consider this: He commissioned not just one, but two, and you can see them both side by side!

We also learned that Jaipur has been a center for gemstone cutting and faceting—particularly of diamonds, rubies and emeralds—for 300 years. The industry took hold in the early 1700s when Sawai Jai Singh II, Maharaja of Jaipur, brought craftsmen and artisans to his palace to produce jeweled sword hilts, pendants, earrings, and—to Nancy's delight—ankle bracelets for the royal elephants. Emeralds were favored, and even today, as much as 50% to 60% of India's gemstone exports are faceted emeralds.

Nearly all emeralds contain fractures and inclusions that make them brittle and difficult to facet, and therefore demand skilled craftsmen experienced with the material. Secrets of the craft have been passed down within families through generations in Jaipur.



These beautiful marble tables contain precious and semiprecious stones as inlay.



The Hindu elephant god, Ganesha, is the patron of arts, learning, and other things.



Gemstone inlay and marble carved in relief or in lattices decorate the Taj Mahal.



Made from 14,000 melted silver coins, this vessel holds 4,000 liters of liquid.

We visited a shop, Bhandari Jewellers, that gave demonstrations of gem cutting with traditional hand-powered tools. They told us the “emerald cut” originated in Jaipur (something I’ve been unable to confirm). They tried to sell us an emerald-cut emerald priced at 1,200,000 rupees. Even though we were assured that translated to “just” \$20,000 U.S. (and that “a deal could be made” if we bought in bulk), that proved too rich for our blood.

We should have known we were in for trouble when we spotted photographs on the wall of two prior customers: the late Princess Diana and Sir Paul McCartney. Visions of rupees—or over-extended credit cards—danced before our eyes. Instead, after much haggling, during which the gemstones presented to us grew ever smaller, we came away with a 0.6-carat stone for 44,551 rupees. I’ll let you figure out the dollar amount. And anyone with a 10X loupe is welcome to enjoy viewing it!

The downside of this story is that countries like Thailand and China have undercut Jaipur in pricing and, given that such gemstone cutting and faceting is a family cottage industry in India, big multinational companies have been muscling them aside. Still, the tradition continues, although now many of the rough emeralds cut here come from Zambia and Brazil rather than from local mines.

At the opposite end of the spectrum, northwest India is famed for its use of architectural stones, including humble red sandstones from its deserts that go by a variety of trade names, including Dholpur Red, Agra Red, and Rajpura Pink. Red, pink and yellow sandstones have been used extensively in the architecture of mosques, forts and palaces, and for the Indian version of the Great Wall of China. Intricately carved, latticed sandstone screens were placed in windows above courtyards where business and civic transactions took place so wives could discretely listen in on conversations of the men below and then tell their husbands what to do.

In addition to such screens, there are elaborate façades. One yellow and red façade gave us an odd sense of déjà vu until our guide pointed out that it appeared in the movie “The Best Exotic Marigold Hotel”, much of which was shot in Jaipur. And, just as she had found her favorite elephants cast in silverwork at a previous palace we visited, here Nancy found a yellow sandstone elephant.

As our journey continued, we were surprised by the extent of the Indian marble industry, though in retrospect, we shouldn’t have been. By the time we got to Agra, in the northern state of Uttar Pradesh, we weren’t that far from the Himalayas, which formed from the tectonic collision of two continental plates. Thus, marble and other metamorphic rocks abound, and marble quarries are everywhere. All along the highways and byways we drove were sales lots brimming with enormous marble slabs, as well as small shops with folks covered in white from the great clouds of marble dust created by cutting, carving and crafting.

The entrepreneurial spirit we saw on display throughout our travels was amazing. Provide even a closet-sized space in a building along a road, and it’s sure to host a shop of some sort, and we saw many such shops selling marble and items produced from marble.

Before we got to Agra, we took a scenic drive through rugged mountains populated with monkeys, which were happy to snatch a bit of bread or fruit from our hands and to peer inquisitively at us through the van windows. Our destination was the gorgeous 15th-century Jain Temple of Ranakpur, crafted from marble. Inside and out, every nook and cranny has been intricately carved and polished by hand. In fact, the temple contains 1,444 carved pillars, and no two are the same.

Nancy pointed out how many of the pillars were supported by carved elephants, and we began spotting them throughout the temple. We also spotted patterns of a lacey quality. For instance, one of the priests—who also serve as guides after morning prayers—highlighted a fresco enmeshed in an intricate Celtic-type knot with no beginning or end.

Although it may not be one of the Seven Wonders of the World, I have seen the temple called one of the Seven Wonders



This familiar-looking, intricately carved façade in Jaipur appeared in the movie “The Best Exotic Marigold Hotel”.

of India and “a poem in stone”. It is one of the five most important pilgrimage sites of the Jain religious sect. If you yourself are a rock carver, you have to add Ranakpur to your bucket list for a pilgrimage of your own. The craftsmanship—and the patience it took to build such a temple stone by stone—will astound you!

It is, frankly, something of a miracle that Ranakpur still exists. Northern India was continuously invaded by Muslim powers—or “Mughals”, as the Indians called them—whose religious proscriptions forbade graven images, so they destroyed much traditional art. At many sites we visited, any sandstone or marble carvings with faces had been smashed.

Although nestled in isolation in the forested Arvallis hills above the river Maghai, Ranakpur was not spared. It fell into disrepair and even wore a deserted look for a long period, but was saved by a renovation effort that restored grandeur and awe to the temple in the late 19th century. Fortunately for us all—rockhound and non-rockhound alike—the inspired marble carvings of Ranakpur persist to produce awe and wonder cast in stone.

A final widespread lapidary art we encountered complemented all that carved marble: inlay, also known by the Italian term of *pietra dura*. If your kingdom was rich in resources, you had inlay using precious and semiprecious stones. If you at

least wanted to *look* rich, you had plaster painted to look like inlaid marble or plaster inlaid with colored glass and mirrors.

Instead of mere mirrors, richer maharajas would have had silver inlay, which created tempting targets for Mughal invaders. We saw one gutted and empty palace that our guide said originally held precious stone-and-silver inlay in its walls. After prying out the stones, an invading army then piled wood in the halls and set it ablaze, capturing the melting silver as it dripped to the floors.

Inlay has become a vibrant cottage industry in the region around Agra. If you go to Home Depot or Lowes and see an inlaid marble table for \$200, buy it—that is, if it's real. You'll sometimes find soapstone substituting for marble and plastics substituting for precious and semiprecious stones. But the real deal is stunning to behold, as we saw in some of the shops we visited. We came away with gifts for friends and family of several nice marble jewelry boxes inlaid with precious and semiprecious stones, as well as an inlaid marble elephant for Nancy's carved elephant collection.

Of course, the only way to conclude an adventure to northwest India is with a visit to the ultimate in marble work: the Taj Mahal. While Ranakpur has been mentioned as worthy of the status of one of the Seven Wonders of the World, the Taj Mahal is undoubtedly on that list. It is

said to be an earthly replica of one of the houses of Paradise, and some of the things we saw up close make it a rockhound's paradise, for sure!

We were surprised to learn that the Taj Mahal is actually more brickwork than marble, which forms just a thin veneer. Had it been crafted entirely of marble blocks, the tomb would not have been able to support its own weight. I had always seen photos of the Taj Mahal from a distance and just assumed it was solid white marble. Therefore, a second surprise was that, up close, you see that the marble is beautifully inlaid with flowers and decorative loops crafted from carnelian, jade, lapis, agate, jasper, and other precious and semiprecious stones.

Much to the disgust of our guide, I noted how my hands were itching for a rock pick and chisel to add to my collection. In addition to the floral motif, which extends to carved relief work as well as inlay, passages of the Koran are inscribed and inlaid with black marble.

Finally, just as maharajas of old visited the Taj Mahal comfortably ensconced atop elephants so, too, did Nancy finally enjoy her day atop a pachyderm as we waved goodbye to our India adventure on a visit to the Amber Fort of Raja Man Singh. Should you ever get to this part of India, it's an indulgence well worth taking. Happy rockhounding, and wherever you may go, may the rocks find you! 💎



In Jaipur, at a spot featured in the movie "The Best Exotic Marigold Hotel", Nancy found her favorite animal carved in sandstone.



Elephants carved in marble abound inside and out at the gorgeous 15th-century Jain temple at Ranakpur.



The Jain temple at Ranakpur is one of the so-called Seven Wonders of India.



Carnelian, jade, lapis, agate, jasper, and other precious and semiprecious stones are inlaid in the walls of the Taj Mahal.



As we haggled for an emerald in Jaipur, the stones grew ever smaller and sweat gathered on the brow of the dealer.

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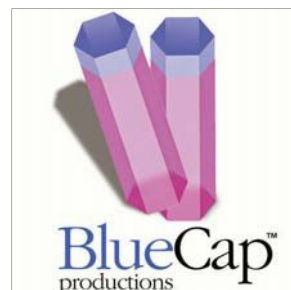
Mineral Lecture Series Online

BlueCap Productions has made recordings of its six-episode 2014 Mineral Lecture Series, presented at the Pueblo Gem & Mineral Show, available for viewing online.

Jeff Swanger, of the OceanView and Pala Chief gem mines in Pala, California, talks about some of the latest discoveries. Jolyon Ralph, of MinDat.org, the world's largest online mineral database, talks about the site and unveils some future plans. Gail Spann, a mineral collector and active champion of bringing more women into the hobby, shares her perspectives on Women in Collecting.

Federico Pezzotta, Curator of the Mineral Museum in Milan, Italy, and a well-known tourmaline and pegmatite expert, talks about the various colors of tourmaline. International videographer and gem dealer of untreated stones Federico Barlocher also talks about his adventures in Mogok: The Legendary Valley of Rubies, in the heart of Myanmar (Burma). Stanley Keith, of MagmaChem Exploration Arizona, talks about New Ideas on the Origin of Oil. Dr. David London discusses the geology of pegmatites.

Listen to the podcasts free at www.buzzsprout.com/35310/.



Roadside Geology of Oregon, 2nd Ed.

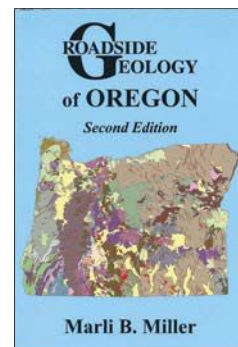
by Marli B. Miller

The part of North America's Pacific Northwest that is encompassed by the state of Oregon is a relatively recent geological creation. Miller takes the reader on a scenic tour of topography that was created by a combination of plate tectonics, volcanism, and seismic activity that commenced only 400 million years ago in the Devonian period (Paleozoic Era). Every other part of the continental United States contains some rocks that are more than 1 billion years old.

The visible evidence of the state's geological history includes numerous mountain ranges, lava plateaus, and basin and range topography. The violent land-shaping events that formed them are also responsible for the wealth of minerals and gemstones found in the state, including agate, jasper, thunder eggs, sunstone and obsidian, as well as fossils of plants and animals.

This edition brings up to date the original volume, which was published in 1978, when plate tectonic theory was just beginning to influence geological research. Its 387 pages are liberally illustrated with color photographs and diagrams.

\$26 (Mountain Press Publishing Co., P.O. Box 2399, Missoula, MT 59806; www.mountain-press.com)



Ohio Rocks! A Guide to Geologic Sites in the Buckeye State

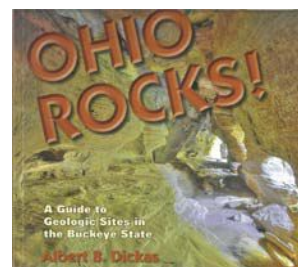
by Albert B. Dickas

Take a new look at the state of Ohio through the eyes of a geologist. Geological events beginning in the Precambrian Era produced three physiographic provinces: the Till Plains, the Lake Plain, and the Appalachian Plateau. The author details 50 sites that illustrate the features of each province.

The Till Plains, named for the deposits of earth and rock left by retreating glaciers, boasts a crystal-filled cavern, strange spherical boulders, and marine fossil parks. In the ice-scoured Lake Plain are a crystal-studded, geodelike cave, still more fossils, and the former domain of the Devonian-period shark Dunkleosteus. The Appalachian Plateau, an eroded plane of sedimentary rock, is home to fossil fuel deposits, large quantities of colorful flint, and a phantom river.

A useful resource for mineral and fossil collectors and geology buffs alike, this 128-page paperback contains 90 color photos and 56 color illustrations.

\$18 (Mountain Press Publishing Co., P.O. Box 2399, Missoula, MT 59806; www.mountain-press.com)



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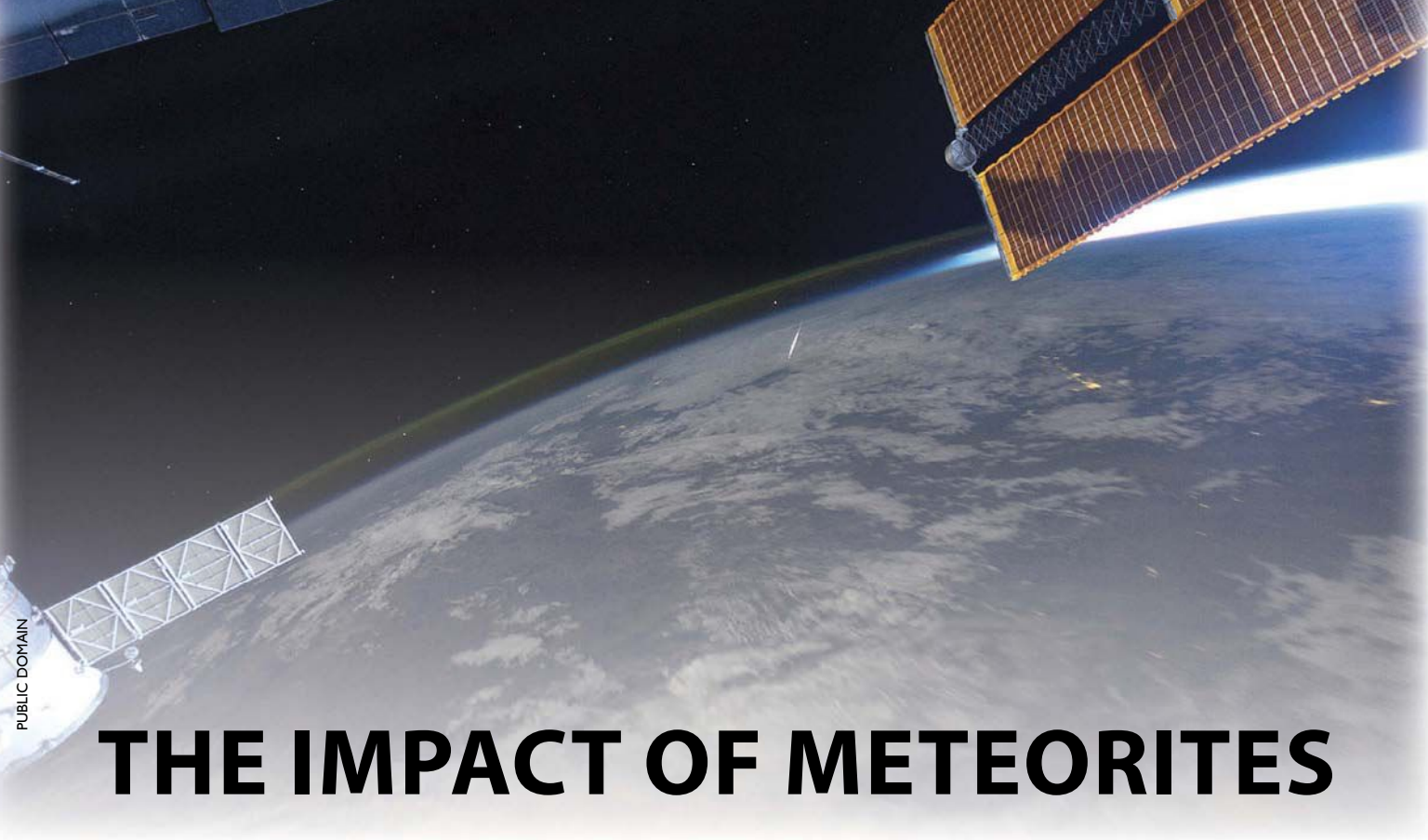
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THE IMPACT OF METEORITES

They Left Their Mark on Our World

Story by Bob Jones

Meteorites are fascinating things. These space rocks are fragments broken from asteroids or comets traveling through inner space. When the fragments, known as meteoroids, enter Earth's atmosphere, the resulting friction generates intense heat. Their path to the planet's surface is marked by a blaze of light, called a meteor, whose appearance inspired the term "shooting star".



This nickel-iron meteorite is nearly a stony-iron because of the large included mineral chondrules.



The Hoba meteorite, which landed in Namibia a little less than 80,000 years ago, is the largest known intact meteorite on Earth, weighing about 65 tons.



This superb example of a stony iron meteorite contains large chondrules of crystalline olivenite. (ASU collection)



A model of Arizona's famous nickel-iron ring meteorite is on display at the University of Arizona.

Meteoroids that contact Earth's surface become meteorites. Oddly, eyewitness reports of freshly fallen meteorites vary. Some report that they are so hot they will convert water to steam. Others tell of frost forming on a fresh fall because it is so cold.

They are not to be confused with comets, which are massive chunks of frozen material—including dust, ice, carbon dioxide, ammonia and methane—that orbit the sun in a far plane that surrounds our solar system. As they pass near the sun, solar radiation and solar wind act upon them to alter their outer layers into a gaseous state. These gasses form coma around the ice ball that gives the comet its fuzzy appearance. Gasses and dust particles follow in the comet's wake, forming a "tail".

Falling meteors may break the sound barrier, creating a booming sound that is often reported by observers. The intense heat caused by friction often leaves shallow depressions on the meteor's surface that scientists call regmaglypts and laymen call thumbprints. It is not unusual for a meteor to actually explode before landing. This scatters chunks in a more or less oval pattern, elongated in the direction of travel, and can even create a crater of good size.

While most meteors disintegrate into tiny particles before they hit the ground, enough sizeable specimens have been recovered to allow scientific study. From this, researchers have come to better understand the universe and our earth.

Science has classified meteorites in three general categories, each with subdivisions. The general forms are nickel-iron, stony iron, and stony, names that give a broad description of their composition. We have been able to further divide these three groups based on mineral composition and structure.

Of the three meteorite types, the easiest to find and recognize are the nickel-irons. These two metals, which account for the bulk of their composition, are somewhat resistant to weathering, since they develop a protective iron oxide crust on their trip through the atmosphere. They can contain trace amounts of minerals—even diamond, a form of carbon, in rare cases.

Solid-metal meteors tend to survive the atmosphere and land on Earth. Their unusual surface features make them easy to recognize, so you would think they are the more common of meteorite falls. Not so! Nickel-iron meteorites represent only about 5% of all Earth's meteorites, but because they are the easiest to recognize, they are the more common type in collections and displays. The most common type of meteor that falls toward earth must be one of the remaining types, stony iron or stony.

A very small percentage (1% or 2%) of falls, as they are called, are composed of both metal and stone. These are the stony irons. The stony meteorites are by far the most common falls, making up well over 90%. So why don't we see more stony

PUBLIC DOMAIN



Meteorites are more easily found in a desert, where they are distinctly different from their surroundings.

BOB JONES PHOTO



These tektites from Southeast Asia show the typical thumbprints caused by partial melting as they entered Earth's atmosphere.

meteorites on display? There are several reasons.

As mentioned, the nickel-irons are comparatively easy to spot, so more of them are recovered. Stony meteorites are far more difficult to identify, as they look a lot like earth rocks. I sometimes get a photo sent to me of what is thought to be a meteorite that turns out to be a piece of slag, volcanic rock, bog ore, or cinder.

Stony meteorites have a dark, gray to black surface. They have no protective surface coating to protect them from weathering, so they deteriorate more easily and blend into surrounding rocks. Our best finds are made in the frozen regions of the earth or in a desert, where the meteorites are distinctly different from their surroundings.

A meteor strike may also produce tektites, small, rounded pieces of black glass that are found in definite patterns around some impact areas. The largest area seems to be in Southeast Asia, where studies have shown the tektites—thousands of them—were probably ejected when a huge meteor smashed into the moon. That collision created one of the most obvious craters, Tycho, on our nearest neighbor.

Pieces of this material were ejected far enough for Earth's gravity to capture them. The area in which the tektites are found includes Hainan Island, off the coast of China. My friend John K.K. Lee visited that island with a friend who helped him collect pieces of tektite. John sent one to me, along with documentation that NASA had analyzed it and determined that it had originated on the moon. They did this by comparing the tektite to information sent back to Earth by a moon lander.

The importance of meteorites is largely overlooked by folks who see them in museums and at mineral shows. They are seen as curiosities and not much more.

Astronomical studies of asteroids, based on meteorite composition and space exploration, have shown that some asteroids have three distinct zones: a metal core, an outer stony crust, and a mix of metal and stone in between. This also describes the three general types of meteorites we have here on Earth, but how does this relate to our planet's structure?

The deepest holes dug by humans only penetrate a few miles into Earth's crust. The Russians drilled a shaft about eight miles deep. The deepest mines are in South Af-

rica, and they are up to five miles deep. Temperatures at this depth are brutally hot. I've been nearly a mile underground in an Arizona mine, where the rock temperature was close to 150°F. I can't imagine what it is like five miles down. Yet, we have a very good idea what Earth's interior is like, right to the core itself. We use seismic waves generated by earthquakes and even atomic explosions to get a good picture of this internal structure.

When a major earthquake occurs, the earth rings like a bell. It sends different types of vibrations radiating in all directions. What's important is that all rocks do not vibrate or transmit vibrations exactly the same way. Solid rock responds to these vibrations in one way, while rock that is in a plastic or liquefied state responds differently. We can emulate these responses in a laboratory, which tells us the type and condition of the rock.

Earth has a solid metal core surrounded by a molten-metal outer core. Above this is what we call the mantle, which is made up of very dense rock with some metal. On top of the mantle floats the less dense surface crust, which is just a few miles thick. Volcanic rock from deep inside the planet

BOB JONES PHOTO



This nickel-iron meteorite from Australia contains a number of olivine chondrules. (ASU collection)

BOB JONES PHOTO



The myriad tiny mineral crystals in this nickel-iron meteorite from Sanderson, Texas, are unidentified. (ASU collection)



As this meteorite plunged through our atmosphere, it partially melted, and atmospheric pressure gave it a cone shape.

confirms these finds. We find high-temperature minerals in volcanic rock of deep origin and minerals that form at much lower temperatures in crustal rocks.

To confirm these findings, we have the three general meteorite types, which closely match the evidence of earth's zoned structure. The study of the minerals in meteorites, asteroids, and even comets is far more detailed and forms a solid basis for this generalized description of the earth's interior.

What is really interesting is that both comets and meteorites are capable of changing the course of human history. Before science proved what meteorites really are, humans created their own explanations and assigned all sorts of meanings to them. The general consensus was that they originated with the gods. Some believed these space objects portended doom, while others saw them as positive omens.

In 1066, the Normans, who considered their leader Duke William the rightful king of England, were squaring off against the Anglo-Saxons, led by King Harold, in what history would call the Battle of Hastings. When a celestial object was seen blazing across the sky, the Normans considered it a good omen. The Anglo-Saxons, however, saw a portent of doom. Duke William prevailed in the battle, killing King Harold. As William the Conqueror, he became England's rightful king. The heavenly harbinger, later proved to have been what we know as Halley's Comet, had a major influence on the war's outcome.

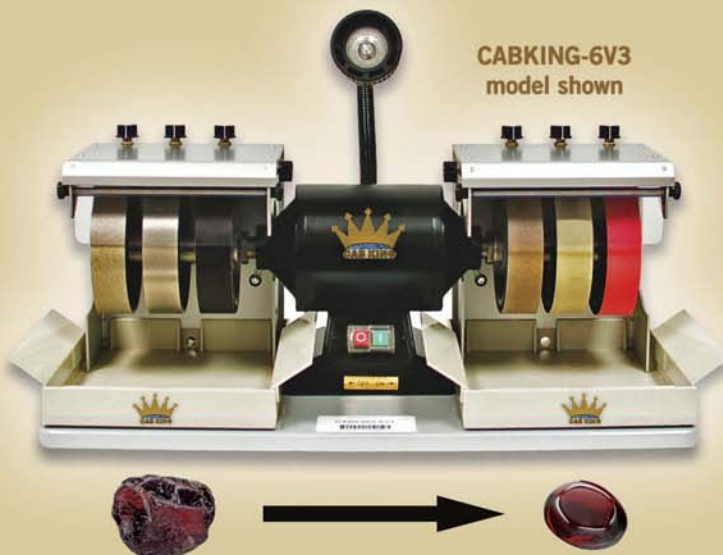
A wonderful example of the effect of space objects on mankind and religion can be found at Mecca, in Saudi Arabia, the birthplace of Mohammed and the spiritual center of Islam. Housed in a shrine called the Kaaba is The Black Stone, which is believed to be a gift from the Angel Gabriel. Mohammed is said to have handled the relic and placed it in the Kaaba, where it resides today. Muslims make an annual pilgrimage, or hajj, to touch and kiss this revered object. (For a more detailed history of this special object, refer to the chapter titled "Godsends from Heaven", by Bernhard Graf, Munich Show theme text "Meteorites".)



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This 320-kg meteorite from the desert of Oman welcomed visitors to the 2014 Munich Show's meteorite display.

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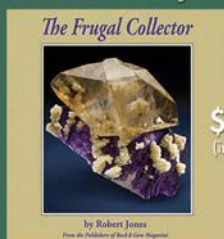
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I've always had a fascination of meteorites, probably because I grew up on a small farm in Connecticut, where the clear night air revealed the heavens to me. Shooting stars, as we called them, seemed magical and we made wishes on them. When I had the chance to see and actually touch meteorites displayed at museums, it brought shooting stars to life for me. This may be why I insisted on visiting the Hoba meteorite in Namibia when Dick Bideaux and I planned a mineral trip to Tsumeb.

The Hoba meteorite is the largest known meteorite on Earth. It weighs about 65 tons, which probably explains why it is still sitting in a rancher's field. In fact, it is so well known that it has been encircled by a nicely built stone terrace, with restrooms nearby.

The Hoba is a nickel-iron type and measures over 8 feet across. It shows the usual thumbprints, but they are quite shallow. It also shows chop and saw marks where people have tried to remove a small souvenir.

As huge as this nickel-iron giant is, its origin is something of a mystery. Since it struck the earth a little under 80,000 years ago, there was nobody around to witness or record the event. No one has been able to

explain how this monster came through the atmosphere nearly unscathed. When huge meteors penetrate Earth's atmosphere, they build up a huge compression wave in front of them. They heat up to the melting point of the metal and very often explode into fragments, which scatter over the landscape for a great distance. Even if they remain intact when they hit the earth they blast out a significant crater.

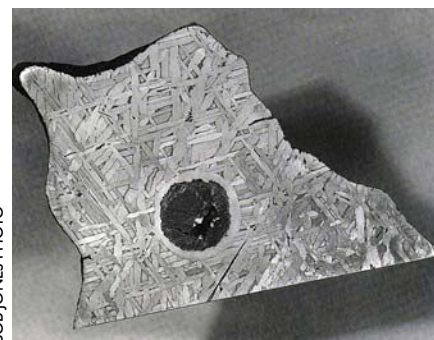
Instead of hitting the earth at the speed of sound, as many large falls do, the Hoba seems to have hit the earth quite gently. There isn't even a noticeable crater made by its arrival. It rests in a shallow depression, indicative of a reasonably slow approach and landing.

Oddly enough, meteorites may be easy to find. I learned in school that, if you gathered all the dust particles in your home's rain gutters and examined them under a microscope, you just might see tiny, dark, round grains that could be micrometeorites, which are constantly raining down from space. In fact, the earth gains tons of space debris every day. As a rockhound, keep an eye out for any rock that does not belong where it is. You just might have found a gift from the gods! ♦



BOB JONES PHOTO

These three stony meteorite fragments are from the February 2013 fall near Chelyabinsk, Russia.



BOB JONES PHOTO

This slice of a nickel-iron meteorite shows Widmanstätten patterns and a single chondrule. (ASU collection)



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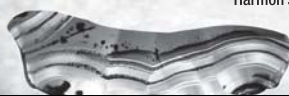
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Show Dates *from page 33*

Admission is free; Beads, Fossils, Gems, Minerals, Crystals, Petrified Wood, Sunstones, Turquoise, Jewelry, Opal, Native American Jewelry, Rough and Polished Rock Free Admission Free Pearls to the first 75 women through the door daily For more info call Jean Miller 971-219-0323 or e-mail karmicbeadsandgems@yahoo.com; contact Jean Miller, (971) 219-0323; e-mail: karmicbeadsandgems@yahoo.com

14-16—PARRSBORO,, NOVA

SCOTIA, CANADA: 50th Annual - Nova Scotia Gem and Mineral Show; Fundy Geological Museum, Lion's Arena; 2163 Western Avenue, Canada; Fri. 10 am-7 pm, Sat. 10 am-5 pm; Adults \$5.00; Celebrating the 50th Anniversary this year, there will be a special gold theme and events throughout the weekend. Over thirty vendors from the region and across Canada. Workshops and demonstrations, field trips and presentations occur throughout the weekend. Originally the Parrsboro Rockhound Roundup founded in 1966 by Eldon George and others from Parrsboro, the Gem Show is the largest show in the Maritime Provinces. The Fundy Geological Museum will also be hosting a Gold exhibit and providing gold activities in a Prospectors Camp throughout the summer. This is the year to visit Nova Scotia! ; contact Sandra Tanner, (866) 856-3466; e-mail: sandra.tanner@novascotia.ca; Web site: <http://fundygeological.novascotia.ca/gemshow>

14-16—LEBANON, PENNSYLVANIA:

Wholesale and retail show; Mid-Atlantic Gem and Mineral Association, Lebanon PA County Fairgrounds and Expo; 80 Rocherty Road; Fri. 10:00 am-6:00 pm, Sat. 10:00 am-6:00 pm, Sun. 10:00 am-4:00 pm; Adults \$6.00, Children are Free!; The Gem Miner's Jubilee is an annual gathering of the finest vendors of gems, minerals, fossils, beads and Jewelry. There are classes and ongoing demonstrations daily. Outdoor tailgate section featuring fine minerals. Free and handicapped parking; air-conditioned halls.; contact Teresa Schwab, PO Box 15513, Chevy Chase, MD 20825, (301) 807-9745; e-mail: beadware@rcn.com; Web site: www.gem-show.com

15-15—SHELTON, WASHINGTON:

Annual show; Shelton Rock and Mineral Society, Shelton Soccer Park; 2102 Johns Prairie Rd; Sat. 9 am-5 pm; Admission is Free; 6th Annual Tailgate Rock Sale and Swap. All rockhounds are invited to bring their rocks, minerals, fossils, and rock crafts to sell or trade. Tailgate space \$15 Raffle, door prizes, rock display. Shoppers and browsers free admission and free parking. Visit our club on Facebook; contact Susan Perrault, Shelton, WA 98584, (360) 275-9432; e-mail: srms242@yahoo.com; Web site: www.sheltonrockclub.weebly.com

15-16—BOSSIER CITY, LOUISIANA:

Annual show; Arklatex G&M Society, Bossier City Civic Center; 620 Benton Rd; Sat. 10:00

am-5:00 pm, Sun. 10:00 am-5:00 pm; Adults \$4.00, Students \$1.00, Children under 12, and scouts in uniform are Free!; "Earth Treasures of Louisiana," Custom and Unique Jewelry, Gems, Minerals, Fossils, Educational Exhibits and Kids Games.; contact Del Glasner, P.O. Box 6633, Bossier City, LA 71171-6633, (318) 517-7372; e-mail: larockclub@gmail.com; Web site: larockclub.com

20-23—WOODLAND PARK, COLORADO:

Annual show; Rock Gypsies, Woodland Park Saddle Club grounds; 19570 E HWY 24; Thu. 9:00 am-5:00 pm, Fri. 9:00 am-5:00 pm, Sat. 9:00 am-5:00 pm, Sun. 9:00 am-5:00 pm; Admission if Free!; The Woodland Park Rock, Gem and Jewelry show is located in the beautiful Rocky Mountains. We have over 40 dealers with Gems and Minerals from all over the world, including Colorado Minerals. You will meet custom jewelers who can sell you beautiful one of a kind jewelry. Kids will have a ball in the kids digging area. Food and fun for everyone and it's all free!! If you can't get enough, The Lake George Rock and Gem cub is also having a show 20 minutes up the road. See 2 shows in one weekend!; contact Kim Packham, (719) 360-9665; e-mail: runninboar@hotmail.com; Web site: woodlandparkrockandgemshow.com

21-23—SAN DIEGO, CALIFORNIA:

Wholesale and retail show; Gem Faire Inc, Scottish Rite Center; 1895 Camino del Rio S; Fri. Noon-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Students, Adults + Seniors \$7, Children ages 0-11 are free!; Fine jewelry, precious & semi-precious gemstones, millions of beads, crystals, gold & silver, minerals & much more at manufacturer's prices. Exhibitors from around the world. Jewelry repair & cleaning while you shop. Free hourly door prizes. ; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: <http://www.gemfaire.com>

21-23—SOUTH BEND, INDIANA:

Show and sale; Michiana Gem & Mineral Society, St. Joseph County 4-H Fairgrounds; Ester Singer Building, 5117 South Ironwood Road; Fri. Noon-7 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Adults \$3.00, Students 6-12: \$1.00, Children under 6 free; Michiana Gem & Mineral Society's 52nd Annual Jewelry, Gem, & Mineral Show and Sale; contact John Davis, South Bend, IN, (574) 232-8823; e-mail: sumu95@hotmail.com; Web site: www.michianagems.org

21-23—LAKE GEORGE, COLORADO:

Annual show; Lake George Gem & Mineral Club, Lot next to Lake George Post Office; 38200 US Hwy 24; Fri. 9 am-5 pm, Sat. 9 am-5 pm, Sun. 9 am-5 pm; Admission is Free; Free parking; good selection local mineral specimens, meet local miners.; contact Rebecca Blair, P.O. Box 171, Lake George, CO 80827, (719) 330-8123 ; e-mail: blairra@hotmail.com; Web site: LGGMClub.org

22-23—PEORIA, ILLINOIS: Annual show; Geology Section of the Peoria Academy of Science, The Grand Hotel; 4400 N. Brandywine Dr.; Sat. 9 am-5 pm, Sun. 10 am-5 pm; Admission is Free!; 52nd annual show; silent auctions; kids area; fluorescent display; panning flume; slabs; specimens; cabochons and faceted stones; jewelry; contact Jim Travis, (309) 645-3609; e-mail: boatnik@aol; Web site: <http://pasgeology.com>

22-23—PEORIA, ILLINOIS: Annual show; Geology Section of the Peoria Academy of Science, The Grand Hotel; 4400 N. Brandywine Dr.; Sat. 9 am-5 pm, Sun. 10 am-5 pm; Admission is Free!; 52nd Annual Show. There will be exhibits of fossils, geodes, specimens of all kinds, cabochons and faceted stones, jewelry, flint knapping and an outstanding fluorescent display. Activities include silent auctions, a kids area with games and prizes, a panning flume, door prizes and much more. Admission and parking are free.; contact Jim Travis, (309) 645-3609; e-mail: boatnik@aol.com

22-23—SAN FRANCISCO, CALIFORNIA: Annual show; San Francisco Gem & Mineral Society, SF County Fair Building; 9th Avenue & Lincoln Way; Sat. 10:00 am-6:00 pm, Sun. 10:00 am-5:00 pm; Adults \$10, Seniors \$8, Students \$8, Children under 12 with adult free ; Dealers, displays, demonstrations, kids' activities, mineral and gem identification, silent and live auctions!; contact Ellen Nott; e-mail: ellen_nott@yahoo.com

22-23—MOUNTAIN HOME, ARKANSAS: Annual show; Ozark Earth Science Gem, Mineral, & Fossil Club, Baxter County Fairgrounds, (Educational Bldg.); 1507 Fairgrounds Drive; Sat. 9 am-6 pm, Sun. 9 am-4 pm; Adults \$2., Seniors \$2., Children under 12 FREE; Ozark Earth Science Gem, Mineral, & Fossil Club is sponsoring it's annual show this year at our NEW LOCATION at the Baxter County Fairgrounds located at 1507 Fairgrounds Drive, Mountain Home, AR. Admission is \$2, active military with ID, Scouts in uniform, & Children under 12 yrs. FREE! Gems, Minerals, Fossils, unique crafts, jewelry, games, hourly door prizes, grand prize drawing, displays, AR. State Geologist for mineral/fossil information, DVD educational programs. Concession on location. Contact Sharon Waddell, 6463 US Hwy. 63, West Plains, MO. 65775, 417-274-8712 or Ernie Confer 870-425-1311; Website: www.ozarkearthscience.org/news.htm; contact Ernie Confer, AR, (870) 425-1311; Web site: www.ozarkearthscience.org/news.htm

28-30—COSTA MESA, CALIFORNIA: Wholesale and retail show; Gem Faire Inc, OC Fair & Event Center; 88 Fair Dr; Fri. Noon-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Students, Adults + Seniors \$7, Children ages 0 - 11 Free!; Fine jewelry, precious & semi-

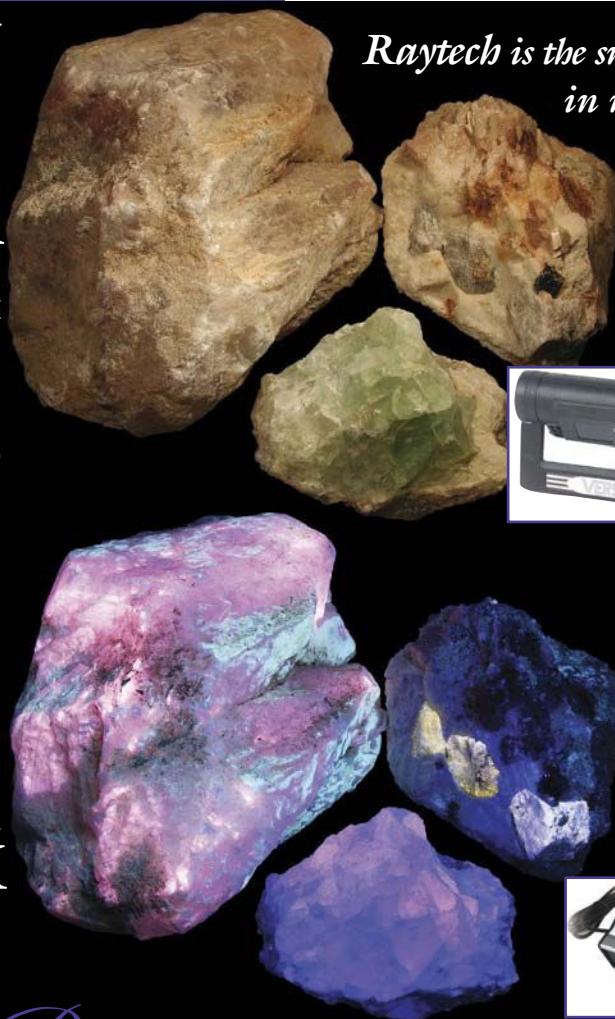
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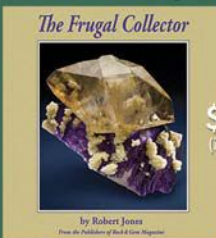
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29-30—FREEPORT, NEW YORK:

Retail show; Freeport Recreation Center, Freeport Recreation Center; 130 East Merrick Road; Sat. 10 am-5 pm, Sun. 10 am-5 pm; Students, Adults, & Seniors \$5.50, Children 12 and under Free!; The show features dealers selling minerals, gems, jewelry, fossils, and beads. Goldsmith and silversmith. Find meteorites from other worlds, and prehistoric fossils from our own. Why pay shopping mall prices when you can get gems and minerals from around the world, and hand crafted gold and silver jewelry directly from the artist. Admission \$5.50, -- With This Ad \$5. Children 12 and under FREE with Adult. Every dollar of the admission fees helps support Freeport Recreation Center programs for children and seniors.; contact Ralph Gose, PO box 1418, Melville, NY 11747, (631) 271-8411; e-mail: ralph_gose@kaleidoscopegemshows.com; Web site: www.kaleidoscopegemshows.com

29-30—ASHLAND, OREGON:

Annual show; Scott's Rocks, United Methodist Church, Wesley Hall; 175 North Main Street; Sat. 10:00 am-5:00 pm, Sun. 12:00 am-5:00 pm; Adults \$2.00; Crystals, minerals, gemstone beads, hand crafted gemstone jewelry, fossils, precious opals. Free admission for children under 12. Silent auction. Free rock for each child. Free fossil leaf field trip on Monday, Aug. 31st. ; contact Scott Blair, (541) 621-2558; e-mail: scottsrocks@scottsrocks.com; Web site: scottsrocks.com

29-30—CONCORD, CALIFORNIA:

Show and sale; Contra Costa Mineral & Gem Society, Centre Concord; 5298 Clayton Rd., near Ygnacio Valley Rd; Daily 10 am-5 pm; Adults \$6.00, Children are Free!; Adults \$6, children (under 16) free; 25 Dealers: gems, jewelry, fossils, minerals, crystals, jade, meteorites & Tektites, fluorescent rocks, lapidary tools & equipment, findings, books; 20 Demonstrations: cabbing, beading, wire-wrapping, faceting, stone setting, stone carving, gold panning, and more; 48 Exhibits and Educational Displays; Activities for all ages: youth and Scout activities, free rock and gem identification, silent auction, fluorescent display room, hourly door prizes, raffle. (Please Note: The August show date is a one-time change. In 2016 the Concord Gem Show will return on the first weekend in November); contact Harry Nichandros, CA, (925) 289-0454; e-mail: show-r@ccmgs.org; Web site: <http://ccmgs.org>

September 2015

4-7—RALEIGH, NORTH CAROLINA:

Retail show; Treasures of the Earth, Inc., NC State Fairgrounds; 1025 Blue Ridge Blvd; Fri. 12 noon-6 pm, Sat. 10 am-5 pm, Sun. 10 am-5 pm, Mon. 10 am-4 pm; Adults \$5.00, Military Free with ID, Children 16 and under Free; Vendors from across the US bring their merchandise to you. You will find • 14K and sterling silver, classic, estate, fashion and handmade jewelry • Loose stones, beads and findings, pearls • Mineral specimens, crystals, lapidary supplies • Books, carvings and gift items ; contact Jane Westbrook, PO Box 59, Gloucester Point, VT 23062, (804) 285-4281; e-mail: jane@treasuresoftheearth.com; Web site: www.treasuresoftheearth.com

5-7—CANBY, OREGON:

Annual show; Jean Miller, Clackamas County Fairgrounds; 694 N.E. 4th Ave., (off Hwy. 99E); Daily 10 am-6 pm; Admission if free; Beads, Gems, Minerals, Crystals, Jewelry, Fossils, Silver, Turquoise, Opal, Sunstone, Petrified Wood, Thunder Eggs, Grab Bags, Rough and Polished Rock and much, much more! Fun for the whole family. Free pearls to the first 75 women through the gate daily For more info contact Jean Miller 971-219-0323 or e-mail karmicbeadsandgems@yahoo.com; contact Jean Miller, (971) 219-0323; e-mail: karmicbeadsandgems@yahoo.com

11-13—GREENFIELD, INDIANA:

Annual show; 500 Earth Sciences Club, Hancock County 4-H Fairgrounds; 620 N. Apple Street; Fri. 10:00 am-7:00 pm, Sat. 9:00 am-7:00 pm, Sun. 10:00 am-4:00 pm; Admission is Free!; Dealers and Swappers in Fossils, Minerals, Gems and Jewelry and Lapidary Equipment Plus Silent Auctions, Door Prizes and much more. Kids Activities, Demonstrations, Educational Displays and Programs for All.; contact Cheryl Hamilton, 3507 Luewan Dr., Indianapolis, IN 46235, (317) 897-6639; e-mail: clhamilton1951@gmail.com

11-13—RENO, NEVADA:

Wholesale and retail show; Gem Faire Inc, Reno Sparks Livestock Events Center; 1350 N Wells Ave; Fri. Noon-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Students, Adults + Seniors \$7, Children ages 0 - 11 Free!; Fine jewelry, precious & semi-precious gemstones, millions of beads, crystals, gold & silver, minerals & much more at manufacturer's prices. Exhibitors from around the world. Jewelry repair & cleaning while you shop. Free hourly door prizes. ; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: <http://www.gemfaire.com>

11-13—ORLANDO, FLORIDA:

Annual show; Central Florida Mineral and Gem Society, FL National Guard Armory; 2809 Fern Creek Ave.; Fri. 1 pm-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Adults \$5, Students \$2; Annual Fall gem, mineral, and bead show will be at the Florida National Guard Armory, 2809 South Fern Creek Ave. Orlando, FL 32806.

Show will be on Friday September 11, 1pm to 6pm, Saturday September 12, 10am to 6pm, and Sunday September 13, 10am to 5pm. Go to www.cfmgs.org for \$1 off coupon. There will be demonstrations, 30 minute auctions, kids table, sluice mining for gems, and hourly door prizes. See and buy gems, minerals, beads, metaphysical stones, fossils and much more from all over the world. Scouts can earn merit badges from a mineral gemologist to assist with identification and requirements. Demos include cutting cabochons, faceting gems, wire wrapping, flint knapping and metal work. Adults \$5.00, Students \$2.00, Scouts free. Free Parking.; contact Paul Hayes, 1400 Sawyerwood Ave, Orlando, FL 32809, (407) 816-1229; e-mail: phayes3@cfl.rr.com; Web site: www.cfmgs.org

11-13—TOLEDO, OHIO: Annual show; Toledo Gem and Rockhound Club, Stranahan Great Hall; 4645 Heatherdowns Blvd.; Fri. 2 pm-8 pm, Sat. 10 am-6 pm, Sun. 11 am-5 pm; Adults \$4, Seniors \$3.50, Students \$3.50, Children under 12 free!; Active Military with ID and Scouts in Uniforms are Free, Exhibits, Lapidary and Jewelry making demonstrations, scholarship raffle, free kids' mineral kits, dealers, club sales; contact Stephen Shimatzki, 4295 County Rd. 16, Woodville, OH 43469, (567) 868-8794; e-mail: sjs132@gmail.com; Web site: www.rockyreader.com

11-13—WINSTON-SALEM, NORTH CAROLINA: Annual show; Forsyth Gem And Mineral Club, Education Building, Winston-Salem Fairgrounds; Enter Gate 9 from 27 th Street; Fri. 10:00 am- 7:00 pm, Sat. 10:00 am-7:00 pm, Sun. 12 noon-5:00 pm; Adults \$3.00, Students K-12 Free; Activities; Gold Panning, Geode Cutting, Grab Bags and Mineral Identification.; contact W. A. Marion, 1163 Bear Creek Church Road, Mocksville, NC 27028; e-mail: mariona1@yadtel.net; Web site: www.forsythgemclub.com

12-13—HANFORD, CALIFORNIA: Annual show; Digginsproductions, Hanford Civic Center; 400 N. Douty St; Sat. 10:00 am-6:00 pm, Sun. 10:00 am-6:00 pm; Adults \$2.00, Children are Free!; Rock, minerals, slabs, fossils. Demonstrations, Jewelry; contact Kathy Corbett, 341 cedar st., Hanford, CA 93230, (559) 904-4795; e-mail: Corbett1@sbcglobal.net; Web site: Digginsproductions.com

12-13—PORT ANGELES, WASHINGTON: Annual show; Clallam County Gem and Mineral Association, Vern Burton Community Center; 308 East 4th Street; Sat. 9 am-6 pm, Sun. 10 am-4 pm; Admission is Free!; contact Jennie Bourassa, PO Box 98, Sequim, WA 98382, (360) 681-0372

12-13—NORTH ADAMS, MASSACHUSETTS: Annual show; Northern Berkshire Mineral Club, Eagles Hall; 515 Curran Highway; Sat. 10 am-6 pm, Sun.

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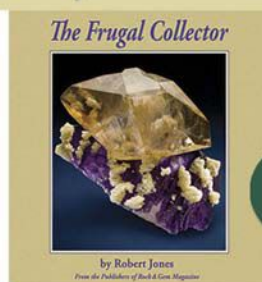
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Show Dates *from page 77*

10 am-4 pm; Adults \$4, Seniors are Free, Students are Free, Children are Free; The show will feature choice minerals, gems, jewelry, gifts, geode cracking, gem panning, door prizes and refreshments.; contact Larry Michon, 385 West Main Street, North Adams, MA 01247, (413) 663-8430; e-mail: lmichon@rcn.com

12-13—WALLA WALLA,

WASHINGTON: Annual show; Marcus Whitman Gem and Mineral Society, Walla Walla County Fairgrounds; 363 Orchard St; Sat. 10 am-5 pm, Sun. 10 am-5 pm; Adults \$2, Children are Free; contact Jack Edwards, (509) 529-3673; e-mail: jcedwards1475@yahoo.com

12-20—DENVER, COLORADO: Annual show; Eons Expos, LLLP, Denver Coliseum; 4600 Humboldt Street; Sat. 9 am-6 pm, Sun. 9 am-6 pm, Mon. 9 am-6 pm, Tue. 9 am-6 pm; Admission is Free; Come see 250 dealers on both levels of the Denver Coliseum plus in 100 tent spaces outside. It's all here: fine minerals, fossils, meteorites, gems, artisan jewelry, gold, silver, lapidary, beads and rough — split evenly between wholesale and retail. Running from Sept 12 - 20, this is Denver's only weekend-to-weekend show and attracts 18,000 visitors of those nine days. With 2,000 tables covered with earth treasures and free parking for 1,500 cars on the 33 acre complex, this is America's largest mineral, fossil, and gem show. The low booth fee and aggressive advertising ensures that the show continues to grow 20% a year. Meet the cast of the TV show 'Prospectors' who will be at the show selling their finds. Peruse the dinosaurs on display. Ogle museum-quality sculptures in solid blocks of clear quartz. Take home a piece of the Moon. Select specimens found in only one place on Earth, being offered by the mine owner herself. Prices range from just \$1 to \$1 million. Free Parking and Admission! ; contact Heather Grana, 235 First Avenue, Keyport, NJ 07735, (973) 903-3256; e-mail: Heather@EonsExpos.com; Web site: <http://ColiseumShow.com>

13-20—DENVER, COLORADO: Wholesale and retail show; Martin Zinn Expositions, L.L.C., Ramada Plaza Denver Central; 4849 Bannock St.; Daily 10:00 am-6:00 pm, Sun. 10:00 am-5:00 pm; Admission is Free!; Two hundred retail and wholesale dealers from around the world offer minerals, fossils, gems, jewelry, beads, meteorites, and decorator items. Over 30 years in the same location, this is Denver's longest-running satellite show, with the best dealers and the best buys.; contact Regina Aumente, PO Box 665, Bernalillo, NM 87004, (505) 867-0425; e-mail: mzexpos@gmail.com; Web site: http://www.mzexpos.com/colorado_fall.html

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ON THE ROCKS

by BOB JONES

2015 East Coast Show

I chose this column's title because that's where the finest East Coast mineral show is held every August. Put on by Zinn Expositions, this show has been serving collectors and dealers for more than two decades. In fact, the East Coast Gem, Mineral and Fossil Show in West Springfield, Massachusetts, is just one of several major mineral shows put on across the country by Zinn Expositions each year. These shows give collectors an opportunity to see the offerings of a full range of dealers—a marked difference in what was available at mineral shows 30 years ago.

If you have ever attended any of these fine shows, you have undoubtedly seen Marty Zinn, the man who heads the team that puts on these shows. With a superior staff, Marty has organized a show in Costa Mesa, California, two in Denver, Colorado, and two in Tucson, Arizona, as well as the East Coast Show. I can't even count the number of mineral and fossil dealers serving the collecting public at these shows. What would collectors and dealers do without these shows?

There is a second major show in the East, the New York/New Jersey Metro Show, which I have touted several times. This show is growing, and now that it has a stable location, it is well worth visiting and enjoying.

The West Springfield East Coast Show was not the first show Marty organized, but it is certainly the most significant event in the east. This year's show, held Aug. 7-9, will be more significant than ever for two reasons.

Each year, Marty invites a major collector to exhibit his or her personal collection for the general public to see. Unlike museum collections, private collections are seldom seen by the public. This show allows collectors to see a superb range of privately owned fine minerals, and it gives viewers some insight into the collecting interest of the collection owner. The variety of collecting interests means that you get to see something different each year.

Some collectors favor quartz or calcite. Others like only minerals with stunning color. Some specialize in a certain country or region. The variety of collector interests is endless. This year, you will see what minerals interest Marty Zinn, because he will be exhibiting his large personal collection at the 2015 show.

I've seen Marty's collection at his home in Colorado. It impressed me, and that's not easy to do since my collecting and viewing experience extends over 70 years. I've visited museums around the world and have seen more private exhibits at shows than I care to count.



The Four Peaks amethyst mine in Arizona was the source of this superb 200-carat purple gem.

My 55 years of visiting and participating in the Tucson Show alone has given me plenty of opportunities to see an amazing range of fine minerals. So when I say you are in for a treat when you see the Zinn collection at the forthcoming August East Coast Show, I'm not exaggerating.

One of the surprises in the Zinn display will be rhodochrosite. You might know that Marty was one of the original investors in the Sweet Home mine project that brought forth the finest rhombic rhodochrosite specimens ever mined. I can't imagine how many superb rhodochrosite specimens came from that project, all of them winners. When the project was finished and the mine sealed permanently, the original investors could select from a large suite of superb specimens. You can expect to see a rhodochrosite exhibit that will highlight Sweet Home mine beauties!

The surprise is that Marty's rhodochrosite exhibit will not feature the fine red specimens for which Colorado is famous. Instead, he will display a fine exhibit of specimens from Argentina and other locations. Frankly, I've always enjoyed rhodochrosite from Catamarcas, Argentina. This classic mine, which was worked by native inhabitants long before the Spaniards showed up, has produced remarkable stalactites of the red mineral that continually amaze collectors. The banded specimens, many of them in the form of disks sliced from those stalactites, have always appealed to me. In fact, I have a small selection of Catamarcas specimens, myself. You'll certainly realize that Marty truly loves rhodochrosite when you see his display.

Contrasting with the rhodochrosite is a display of variscite from Fairfield, Utah.



One of the adventures I'll share is my helicopter trip to the Four Peaks amethyst mine at 7,000 feet.

These rich-green phosphate specimens are beautifully patterned from the variety of phosphate species that make up each specimen. One very colorful slice you'll see was once in the Bob and Evan Jones collection: a lovely green variscite with a stripe of bright-yellow crandallite cutting through the disk. This classic was originally collected by Ed Over and Art Montgomery.

Marty's interest in minerals spans the entire mineral spectrum, from recent to classic. He has brightly colored minerals, black minerals, recently mined minerals, and classics from bygone years. His display will feature a full range of superb examples of the world's minerals. One exceptional specimen is a cluster of gem cuprite crystals from Onganja, Namibia. The crystals are lightly coated with bright-green malachite, which obscures the gemmy interior of the cuprite. Nonetheless, this group of several cuprite crystals is impressive.

Since my heritage is English-Welsh, it is reasonable for me to enjoy fine minerals from England, so I was pleased to see a number of choice English minerals in Marty's collection. Yet, I was utterly surprised when he pulled from a drawer an example of siderite after fluorite from the Virtuous Lady mine in Devon. This mine, which was reportedly active since before 1807, is classically famous for the most unusual pseudomorph minerals ever found in England. The mine was named for Queen Victoria, aka The Virgin Queen. The pseudomorphs—actually casts—are very rare and eagerly sought. Only a handful of specimens survived the ages and you'll get to see one of them at the show.

The sequence of formation for these amazing specimens is fascinating to me. First, a cubic fluorite crystal formed. After a period of time—who knows how long—a new solution entered the crystal pocket and deposited a new species on top of it. Crystals of siderite almost completely coat the fluorite with dark-brown crystals. Oddly, in the casts that I have seen from the Virtuous Lady, one side of the siderite coating is always missing; it never formed or was removed by the miners so they could peer inside.

This can also be unusual because another solution may attack the specimen and actually dissolve away the fluorite completely. This leaves only the siderite in an empty, boxlike form. This is a most remarkable example of a mineral cast, as the siderite preserves the cube form of the now-missing fluorite. The finest of these casts is in the Natural History Museum, London. I've only seen a few such siderite casts, so the one in Marty's collection will be a treat.

Another surprise is planned for *Rock & Gem* readers who attend the East Coast Show. My son Evan will be there as a speaker. Both my sons, Bill and Evan, give lectures. Bill is a railroad buff and has given talks on old railroads and old mines in Colorado, where he lived for years. In



One of the rare beryllium minerals you'll see at the East Coast Show is this superb example of helvite from the Huangangxian mine (Upper Mongolia, China).

fact, he gave a mining talk to the Friends of Mineralogy at their annual Colorado Symposium in Ouray, Colorado, in September 2014. Bill will not be at the East Coast Show, but you will enjoy hearing Evan's talk on the amazing azurite source at Milpillas, Sonora, Mexico.

The Milpillas copper deposit has produced azurites that rival, and sometimes exceed, those from the classic sources of Bisbee, Arizona, and Tsumeb, Namibia. This mine is particularly noted for its electric-blue azurite. These are most interesting azurites, since they are examples of sequential crystallization.

The electric-blue azurites initially formed in fine, sharp crystals. If the oxygen content in the solution changes, the azurite alters to malachite, thus creating a pseudomorph. This happened to a lot of the Milpillas azurite, so the mine is well known for fine malachite pseudomorphs after azurite. But in some cases, the malachite pseudomorphs are later invaded by yet another azurite-rich solution, and this blue mineral forms a thin, transparent coating on the green malachite. When light strikes the face of these crystals, it passes through the thin azurite coating, strikes the underlying dark-green malachite, and reflects back through the azurite coating. The effect is stunning as the bright-blue color of the azurite turns electric blue. Collectors love this effect, and electric blue azurites are the most popular of the Milpillas specimens. Evan's talk features these azurites and explains the geology and mineralogy of the copper deposit, which excited the collecting world with its colorful azurite and malachite.

Naturally, if Evan is giving a talk at the East Coast Show, I have to be there. A couple of years ago, after giving talks at this show for years, I decided to take time off, but I cannot resist being there when Evan gives his talk. In fact, I saw a golden opportunity to introduce Evan for his talk. I am so lucky to have a son who has the same inter-

ests as I do. In fact, he knows more about minerals than I ever did. You'll find that out when you talk to him! Actually, I have to be careful how I introduce Evan because he will introduce me when I give a talk.

Marty has asked me to give three talks, one each day. As of this writing, I'm working on a talk on the lead minerals. They have always been among my favorites because of the variety of species, most of them very colorful. Last year, I took a helicopter flight to the top of the 7,000-foot-high Four Peaks Mountains east of Phoenix. The mine there produced some of the finest rich-violet amethyst in the world. I hiked there on my first trip and was really hard pressed to survive because it had snowed. That accounts for the helicopter trip on visit two. That may be the third talk of my group of three. Talk number two could very well be "A History of the Tucson Show".

There will be yet another feature at the 2015 East Coast Show that you will not want to miss. Marty is getting together a few of us old-timers who have collected for years. We will hold a panel discussion featuring some of our adventures and crazy experiences we've had. You can bet the tall tales will fly back and forth. You don't want to miss that session. I'm making notes so I won't leave out any of my adventures. I've met some real characters in my travels and collecting trips. For instance, would you believe I met a man who converted The Beatles to the Hari Krishna movement and discovered a ruby mine in India? Don't miss this session! 💎

Bob Jones holds the Carnegie Mineralogical Award, is a member of the Rockhound Hall of Fame, and has been writing for *Rock & Gem* since its inception. He lectures about minerals, and has written several books and video scripts.





PARTING SHOT

MINERALS and JEWELRY



Ray Mine Gem Chrysocolla

I picked up this material at a gem and rock show. The colors and patterns really caught my eye, but they were nothing compared to what I found on the inside. After I cut the second slab, an amazing druzy pocket opened up. It took a lot of extra time and patience to carefully cab around the opening of the pocket and not collapse the outer walls that framed the druzy.

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